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LIST OF PAPERS.

Page

Baker, J. G., F.R.S., F.L.S.

On a Collection of Ferns made in North Borneo by the Bishop of Singapore and Sarawak. (Plates XI. & XII.) 222

Further Contributions to the Flora of Madagascar 441

Ball, John, F.R.S., M.R.I.A., F.L.S.

Contributions to the Flora of the Peruvian Andes, with Remarks on the History and Origin of the Andean Flora............ 1

Notes on the Botany of Western South America 137

Bolus, Harry, F.L.S., and N. E. Brown, A.L.S.

Contributions to South-African Botany.—Orchideæ. Part II. With Additional Notes by N. E. Brown, A.L.S. (Plate I.).. 65

Bonavia, E., M.D., Brigade-Surgeon, Indian Med. Depart.

On the probable Wild Source of the whole Group of Cultivated True Limes (*Citrus acida*, Roxb., *C. medica* var. *acida* of Brandis, Hooker, and Alph. de Candolle). (Communicated by W. T. Thiselton Dyer, C.M.G., F.R.S., F.L.S.) (With 3 woodcuts)...................................... 213

Brown, N. E., A.L.S., and Harry Bolus, F.L.S.

Contributions to South-African Botany.—Orchideæ. Part II. With Additional Notes by N. E. Brown, A.L.S. (Plate I.) 65

Clarke, Charles Baron, F.R.S., F.L.S.

Botanical Observations made in a Journey to the Naga Hills (between Assam and Muneypore), in a Letter addressed to Sir J. D. Hooker 128

Page

DARWIN, FRANCIS, F.R.S., F.L.S.

On the Relation between the "Bloom" on Leaves and the Distribution of the Stomata 99

DRUERY, CHARLES T., F.L.S.

On a new Instance of Apospory in *Polystichum angulare*, var. *pulcherrimum*, Wills. (With 3 woodcuts.) 437

GARDNER, J. STARKIE, F.L.S., F.G.S.

Remarks on some Fossil Leaves from the Isle of Mull (Scotland) 219

HEMSLEY, W. BOTTING, A.L.S., Assistant for India in the Herbarium, Royal Gardens, Kew.

Report on the Vegetation of Diego Garcia 332

HENSLOW, Rev. GEORGE, F.L.S.

A Contribution to the Study of the Relative Effects of Different Parts of the Solar Spectrum on the Transpiration of Plants .. 81

ITŌ, TOKUTARŌ, F.L.S.

Berberidearum Japoniæ Conspectus. (Communicated by W. T. Thiselton Dyer, C.M.G., F.R.S., F.L.S.) (Plate XXI.) 422

LUBBOCK, Sir JOHN, Bart., Pres. Linn. Soc., F.R.S., M.P., D.C.L., LL.D.

Phytobiological Observations: On the Forms of Seedlings and the Causes to which they are due. (With 134 woodcuts.) .. 341

MASTERS, Dr. MAXWELL T., F.R.S., F.L.S.

Contributions to the History of certain Species of Conifers. (Plates II.–X. and woodcuts.) 169

On the Floral Conformation of the Genus *Cypripedium*. (Plate XX. and 10 woodcuts.) 402

MITTEN, WILLIAM, A.L.S.

Some new Species of the Genus *Metzgeria* 241

The Mosses and Hepaticæ collected in Central Africa by the late Right Rev. James Hannington, Bishop of Mombasa, F.L.S., F.G.S., &c., with some others, including those gathered by Mr. H. H. Johnston on Kilimanjaro. (Plates XV.–XIX.) .. 298

Page

Ridley, Henry N., M.A., F.L.S., Assistant, Botanical Department, British Museum.

On Dr. Fox's Collection of Orchids from Madagascar, along with some obtained by the Rev. R. Baron, F.L.S., from the same island 116

On the Freshwater Hydrocharideæ of Africa and its Islands. (Plates XIII. & XIV.) 232

A Monograph of the Genus *Liparis* 244

Trimen, Henry, M.B., F.L.S., Director Roy. Bot. Gardens, Peradeniya, Ceylon.

Note on *Balan hora Thwaitesii*, Eichl. 330

EXPLANATION OF THE PLATES.

PLATE

I. SOUTH-AFRICAN ORCHIDS. Floral parts of species of *Disperis*.

II. ABIES AMABILIS, sterile branch.

III. BRITISH grown cones of *A. grandis*.

IV. A. NOBILIS, British grown cone and sections of leaf.

V. CONES of *A. nobilis*, var. *magnifica*.

VI. A. RELIGIOSA, cone and foliage.

VII. FRUIT AND FOLIAGE of *Cephalotaxus pedunculata*, var. *sphæralis*.

VIII. PICEA OMORIKA, cones and foliage.

IX. CONES AND FOLIAGE of *Pseudolarix Kæmpferi*.

X. BRANCH and Fruit of *P. Kæmpferi*.

(II.–X.) Illustrations of Dr. Masters's paper on History of Conifers.

XI., XII. BORNEAN FERNS, *Nephrodium stenophyllum*, and *Trichomanes Hosei*, after J. G. Baker.

XIII., XIV. AFRICAN HYDROCHARIDEÆ, viz. *Boottia exserta* and *Blyxa radicans*, as described by H. N. Ridley.

XV., XVI., XVII., XVIII., XIX. CENTRAL-AFRICAN Mosses and Hepaticæ, various species and details, accompanying Mr. W. Mitten's paper on Bishop Hannington's and Mr. Johnston's collections.

XX. PELORIATE Flower of *Selenipedium caudatum*, illustrating floral conformation by Dr. Masters.

XXI. ACHLYS TRIPHYLLA, var. *japonica*, as defined by Tokutarō Itō.

ERRATA.

Page 37, twelfth line from bottom, *for* "INCANUM" *read* INCARUM, the author desiring the species to bear the name of the Incas.

In Plate XXI. for *Achrys* read *Achlys*; the text, p. 435, is correct.

THE JOURNAL

OF

THE LINNEAN SOCIETY.

Contributions to the Flora of the Peruvian Andes, with Remarks on the History and Origin of the Andean Flora. By John Ball, F.R.S., M.R.I.A., F.L.S., &c.

[Read 5th November, 1885.]

In the month of April 1882, I was able to make a short excursion in the Peruvian Andes, near to Lima, and to collect a good many plants of the middle and higher regions. Finding that my collections include a fair proportion of undescribed species, and present an occasion for some remarks on the vegetation of the great range of the Andes, I offer to the Linnean Society an enumeration of the species collected, with brief descriptions of those hitherto undescribed, and of some remarkable varieties, with a few preliminary observations on the general character and possible origin of the flora.

Owing to the disorganized state of the country during the war between Chili and Peru, it was necessary for me to keep within the portion of the territory occupied by the Chilian forces. This fortunately included the remarkable line of railway destined to connect Lima with the interior by the valley of the Rimac, and the pass leading thence to Oroya, which lies on the eastern side of the highest range of the Andes. Before the collapse of the finances and regular administration of the government of Peru, the line had been completed and opened as far as Chicla, the

highest village in the valley of the Rimac, and to that place I proceeded in company with my friend Mr. Richard Ward, to whom I am indebted for kind assistance in collecting plants and for several plants gathered by him in a subsequent visit, which have added twelve phanerogams and one fern to the following list.

Of the three days spent at Chicla two were employed in the neighbouring part of the Rimac valley, while one was destined to an excursion to the upper region towards the summit of the western ridge of the Andes, commonly distinguished in Peru as the Cordillera. Unforeseen difficulties and delays limited the extent of this excursion. Less than two hours were available for botanizing, about 600 feet above the wretched hamlet of Casapalta, at a height of about 14,300 feet above the sea, and in going and returning it was necessary to pass by spots which would have afforded many additional species. It is obvious that a collection made under such circumstances must fail to give an adequate representation of the flora of even the single valley to which I was confined; but as I find that it includes much more of novelty than I could have expected, it seems to supply a slight contribution to our knowledge, and occasion for discussing some questions connected with the history and distribution of the Andean flora.

I must remark that, as my excursion from Lima was limited to the western slope of the outer range of the Peruvian Andes, the statements here made must be understood to refer to that region only. Of the extensive plateau region lying between the great parallel ranges—the western and highest, known in Peru as the Cordillera, and the eastern, to which the term Andes is there exclusively confined—and of the eastern slopes towards the Brazilian frontier, forming what is termed the *montaña*, I have no personal knowlege. The climatal conditions of the two regions are very different, those of the *montaña* in particular being characterized by abundant, and in some parts by excessive, rainfall.

As is well known, the coast region of Peru is marked by excessive aridity, and is commonly termed rainless. This is not strictly accurate, as slight showers of rain recur at intervals, which may be as long as three or four years, and during the winter (June to August) dense fogs prevail over the low lands, which must deposit a considerable amount of moisture, often in the form of fine rain or Scotch mist, and the country, at least in the neighbourhood of Lima, then produces an abundant though short-lived vegetation. The ridge of the Cordillera in Central

Peru is in most parts within less than 100 miles of the sea-coast, and the flora suffers in consequence from the deficient supply of moisture, and is poorer both in individuals and in species than in the plateau region, which is better watered. On this subject I found, however, reason to modify somewhat the statements of writers of authority which are summed up in the 20th chapter of Grisebach's great work on the 'Vegetation of the Earth.'

The distance from Lima to Chicla is little over 70 miles; but as the former stands only 468 feet above the sea, and Chicla at the level of 12,220 English feet, the ascent surpasses in height and steepness anything hitherto accomplished by railway engineers. For a distance of about 24 miles the valley slopes upward very gently, and to a person travelling, as I did, at the latter end of the dry season, the appearance of the surface is that of absolute sterility, except along the banks of the Rimac, or along rare irrigation channels. The land is not, however, absolutely devoid of vegetation; some small *Amarantaceæ* (*Alternanthera*, *Telanthera*), the cosmopolitan *Portulaca oleracea*, *Heliotropium parviflorum*, *Boerhavia viscosa*, *Franseria ambrosioides*, and one or two other unattractive flowering plants, occur here and there, and prove that the climate here is not so absolutely dry as it is in southern Peru and northern Chili, where the high range of the Andes is more distant.

As the valley becomes gradually narrowed between the projecting ridges of the mountains, appearances of vegetation rapidly increase. Cactoid plants (apparently belonging to three species of *Cereus*) and the nearly withered stems of a large Bromeliaceous plant (*Puya*?) are seen on the rocky slopes, which are furrowed by channels cut by running water; and about San Bartolomè, nearly 40 miles from Lima and 5000 feet above the sea, a tinge of green on the declivities becomes perceptible even at this season, and a slight trickle of water may be noted in some of the lateral ravines. Flowering plants, especially *Compositæ* of the genera *Tessaria*, *Baccharis*, *Viguiera*, *Encelia*, *Bidens*, *&c.*, show themselves in the bed of the valley, but the species are for the most part the same that are seen in irrigated places near the coast. At Surco, 6655 feet above the sea, are some gardens in which tropical fruits (*Anona Cherimolia*, bananas, granadillas, &c.) are successfully cultivated. Up to this point it would appear that the change of climate, so far as regards temperature, must be very slight. The decrease due to increasing elevation is compensated

by the fact that the valley is to a great extent protected from the influence of the southern currents of the air and ocean, which cool, to an abnormal extent, the sea-board of Peru; while the increased effect of solar radiation probably makes the heat by day greater than at Lima. In this part of the valley tree-vegetation of a stunted aspect becomes more prominent. Besides *Salix Humboltiana*, which follows the banks of the Rimac, *Schinus Molle*, and an *Acacia* (?) with thick trunk and stiff spreading branches, but only 12 or 14 feet in height, are the most conspicuous forms.

About 55 miles from Lima, and 7800 feet above the sea, stands San Juan de Matucana, the chief place in the valley. Judging from the fact that many of the characteristic species and even genera of the lower zone disappear above this height, while numerous types characteristic of the Andean region are first seen above Matucana, I have fixed on that place as the lower limit, in the Rimac valley, of what I may call the middle zone of the western Andes. So far as I know, that region is not marked in Peru by the predominance of any vegetable group, such as we find in the Cinchona forests of Columbia. Its natural limits are fixed by a temperate climate, with a very restricted range of the thermometer, combined with occasional though scanty rainfall throughout the year. In this valley its lower limit is marked by that of *Heliotropium peruvianum*, which appears to range from about 8000 to 10,000 feet above the sea; while its upper limit may be indicated by that of the suffrutescent *Calceolariæ* and of *Lupinus paniculatus*.

The most positive conclusion to which I was led by my visit to Chicla was that, so far as regards this part of Peru, the limit of alpine vegetation has been placed by writers on the subject far too low. There can be no serious error as to the heights given in this paper, which are based on the measurements of the railway engineers; and in departing for Chicla, 12,220 feet above the sea, I fully expected to find myself in the alpine zone of the Andean flora, which Grisebach, on the testimony of Tschudi and other travellers, has placed for Peru and Bolivia between the level of 11,508 English feet and the line of perpetual snow. Following Humboldt, Grisebach places the inferior limit in the Andes of Ecuador and Columbia at the still lower level of 10,872 feet. In the valuable notes contributed by M. André to the French edition of Grisebach's work many facts are given to show that the out-

lines laid down by Humboldt for the vast region lying within eight or ten degrees on either side of the equator must be extensively modified; and, as regards the Peruvian Andes, my brief experience satisfied me that received opinions require no less considerable correction.

On first sallying forth on the morning after my arrival at Chicla, I found with surprise that all the conspicuous types of vegetation belonged to the temperate, and not to what naturalists designate as the alpine zone. Five species of *Calceolaria*, *Alonsoa*, a beautiful *Clematis*, a large *Lupinus* forming dense masses on the slopes, a large red-flowered *Echeveria*, several conspicuous species of *Bidens*, fruticose species of *Solanum*, a *Nicotiana*, *Verbena diffusa*, and many others of similar character, all proclaimed the prevalence of a temperate climate in which frosts are rare and of short duration. The impression thus received was confirmed when I was able to compare the vegetation at this level with that of the true alpine zone, about 2000 feet higher than Chicla. Of 46 species hastily gathered at the upper station, only eight were common to Chicla, and of these, three only could be reckoned as characteristically alpine, viz.:—*Draba siliquosa*, *Alchemilla pinnata*, and *Saxifraga cordillerarum*. It is needless to say that in all countries the limits in altitude of zones of vegetation are subject to variation from local causes, and it is useless to attempt great accuracy. Judging, however, from my own observation, I should place the lower limit of the alpine zone on the western side of the Peruvian Andes between 12,500 and 13,000 English feet above the sea, sometimes, perhaps, even above the latter limit. In ascending the valley above Chicla, at a height rather exceeding 13,000 feet, we passed a farm-house where corn of some kind had been sown, and where some trees of *Sambucus peruviana*, probably planted, had reached a height of 25 or 30 feet. This, which is the sole representative of arboreal vegetation in the upper valley, could scarcely thrive in the true alpine zone.

The explanation of the relatively high extension of the temperate flora in this region is naturally to be sought in climatal conditions, which are in many respects peculiar. Observations of the thermometer are, indeed, not forthcoming; but there is abundant proof that the oscillations of temperature are very moderate throughout the year, and that, although the nights are always cool, frost is scarcely known. Between the 21st and 24th

April—corresponding to October in the northern hemisphere—I found the mean temperature at Chicla about 52° Fahr., the extremes observed being 65°·7 at noon on the 21st, and 42° soon after sunrise on the 22nd, before the rays had reached the adjoining slopes. Rain, according to local information, occurs sparingly at irregular, but not distant, intervals throughout the year. On the night of the 21st rain fell in some abundance, and lay in the form of snow on the higher parts of the range above the level of about 15,000 feet, but had nearly disappeared two days later. It would appear that as to the two main factors of climate—temperature and moisture—there is a considerable difference between the *puna*, or plateau region between the two great ranges of the Andes, and places of equal elevation on the western slope. Poeppig, Tschudi, and other scientific travellers, agree in speaking of the frequency of storms in the *puna* region, which, at heights little exceeding 12,000 feet, are often accompanied by heavy snow, and they record relatively sharp frosts at places not much higher than Chicla. Speaking roughly, I am inclined to place the lower limit of the Alpine zone on the *puna* at about 12,000 feet. It may be taken for granted that with a moister climate the alpine —or proper Andine—flora is more fully developed there than on the drier western slopes, while a few xerophilous species may be confined to the latter region.

Speaking of the Equatorial Andes, M. André is disposed to divide the region above the temperate zone, admitting a *subandine* as well as an *andine* zone, the latter corresponding to the alpine zone of Grisebach and other writers. I was not satisfied that the facts justified such a subdivision in the limited field of observation open to me. Some species are doubtless limited to the lower part, and some others to the upper part of what I have termed the temperate zone; but I perceived no indications of a general change in the constituents, or in the aspect of the flora, excepting those which I have already specified, and I should divide the vegetation of the valley that extends from the watershed of the western Cordillera to the mouth of the Rimac near Callao into three zones—a subtropical dry zone, ascending from the coast nearly to the level of 8000 feet; a temperate zone, reaching to a height of 12,500 or 13,000 feet; and, finally, an alpine zone, extending upward to the crest of the Cordillera. The projecting eminences on the crest must certainly attain the height of 17,000 feet above sea-level, and some of them may

probably exceed that limit by nearly 1000 feet; but I doubt whether snow lies permanently on any of these summits. Comparing the rather scanty details given by Poeppig*, who followed the more direct line from Lima to Cerro de Pasco by Canta and Culluay, I should infer that the character of the flora of the western slope is there very similar to that of the upper valley of the Rimac.

In discussing the regions of vegetation in the Equatorial Andes, M. André says that there is there no zone characterized by the growth of alpine grasses, and that where these abound they have occupied ground which, in a natural state, was covered by shrubs and low bushes which have been destroyed by fire. This statement obviously refers to a zone considerably lower than that which I saw above Casapalta, between 13,800 and 14,300 feet above the sea. I do not believe that this can have ever supported a vigorous growth of shrubs; and, as regards the number of individuals, grasses undoubtedly took the first place, although here, as everywhere in South America, the Compositæ showed the greatest variety of species. As happens in all high mountain regions, they are intermixed with species of the characteristic alpine flora, but the grasses give the dominant aspect to the vegetation.

The most singular plant seen by me in the higher zone was a member of the Cactus family, of which I am unable to find any description. It forms large, low, cushion-like masses, several feet, or even several yards, in diameter, completely covered by long glistening silky white hairs which conceal the slender needle-like spines with which the whole plant is beset. At a little distance the plants were taken for patches of snow. Unfortunately the specimen sent to Kew with a view to cultivation arrived in a state of partial decomposition.

It has been generally asserted, or taken for granted, by writers of authority that the flora of the tropical Andes is relatively poor as regards variety of species. There is some reason to think that, as compared with the highlands of Mexico, this idea is well founded; but I doubt whether it holds good on a comparison with the floras of other high mountain regions. It must be remembered that the vast region included under the term Andes is still most imperfectly explored by naturalists. Excepting, indeed, the Andes of Central Chili, between the 32nd and 37th degrees

* Reise in Chili und Peru, vol. ii.

of south latitude, only a few points at wide distances asunder have been visited by botanists, and each of these has supplied numerous species not yet known to grow elsewhere. Strong confirmation of this opinion may, I think, be found in the fact that a hurried visit to a valley situated in the most sterile portion of the great range should have produced out of a total number of about 210 indigenous species, 17 undescribed, to which I have felt it necessary to assign names, besides five or six more, almost certainly new, which I have preferred to leave unnamed. Of the 17 species, three are identical with plants, hitherto unnamed, existing in European herbaria, and I feel sure that many more Andean species remain to be added from this source. A slight visit to the herbarium of M. Lombardi at Lima satisfied me that a further considerable amount of undescribed materials must exist among the collections of that gentleman and of other South American botanists.

The accompanying list of plants collected in the upper Rimac valley, between the limits of 7,800 feet and 14,300 feet above the sea, includes 224 species and six marked varieties, of which two or three may hereafter be ranked as distinct species. Of the plants enumerated nine appear to have been certainly introduced by the agency of man, viz.:—*Capsella Bursa-pastoris*, *Lepidium virginianum*, *Erodium cicutarium*, *Erodium malacoides*, *Medicago denticulata*, *Melilotus indica*, *Centaurea melitensis*, *Solanum tuberosum*, and *Paspalum stoloniferum*, and I have thought it best to omit these from the tables given below. To the list of introduced species many botanists would add the following five:—*Cerastium glomeratum*, *Stellaria media*, *Galium Aparine*, *Gnaphalium luteo-album*, and *Poa annua*. As regards each of these, however, I think that the weight of evidence goes to prove that their wide diffusion throughout the world, and specifically in South America, is mainly due to agencies other than the interference of man, and especially to transport by birds.

In the subjoined table I have sought to exhibit the distribution of the species collected in the upper Rimac valley, distinguishing those found only in what I may call the lower temperate zone, between 7,800 and 11,000 feet above the sea, from those found only about Chicla, between 12,000 and 12,600. The number in the former category has been increased by 13 species, collected by Mr. Ward above Matucana in the month of May, and not seen by me.

Table showing the Distribution of the Indigenous Species belonging to each Natural Order of Plants collected in the Upper Valley of the Rimac.

Natural Order.	Lower temperate zone exclusively.	Common to lower temperate zone and to Chicla.	About Chicla exclusively.	Common to Chicla and alpine zone.	Alpine zone 14,000′ to 14,300′ exclusively.	Total number of species.
Ranunculaceæ ...	......	......	3	......	......	3
Cruciferæ	......	2	3	1	1	7
Capparideæ	1	......	......	......	......	1
Polygalaceæ	......	......	1	......	......	1
Caryophylleæ ...	......	......	6	......	1	7
Portulacaceæ......	......	......	2	......	1	3
Malvaceæ	1	3	......	......	......	4
Geraniaceæ	1	2	2	1	......	6
Leguminosæ	1	......	3	......	3	7
Rosaceæ	......	......	2	1	......	3
Saxifrageæ.........	......	......	......	1	......	1
Crassulaceæ	......	......	4	......	......	4
Onagrarieæ	1	......	2	......	1	4
Loasaceæ	1	1	2	......	......	4
Passifloraceæ......	1	......	......	......	......	1
Cucurbitaceæ......	......	......	1	......	......	1
Datisceæ	1	......	......	......	......	1
Umbelliferæ	2	1	3	......	......	6
Caprifoliaceæ......	......	......	1	......	......	1
Rubiaceæ	1	......	1	......	1	3
Valerianeæ.........	......	......	2	......	1	3
Compositæ.........	6	7	21	2	14	50
Campanulaceæ ...	......	......	......	......	1	1
Asclepiadeæ	......	......	1	......	......	1
Gentianaceæ	1	......	1	......	2	4
Polemoniaceæ ...	......	......	2	......	......	2
Hydrophyllaceæ .	......	......	1	......	......	1
Boragineæ	2	......	3	......	......	5
Convolvulaceæ ...	1	......	1	......	......	2
Solanaceæ	5	1	3	......	......	9
Scrophularineæ...	1	......	8	......	2	11
Bignoniaceæ	1	......	......	......	......	1
Verbenaceæ	1	1	1	......	......	3
Labiatæ	2	1	......	......	......	3
Plantagineæ	......	......	2	......	......	2
Nyctagineæ	1	......	......	......	......	1
Amarantaceæ ...	1	......	......	......	......	1
Chenopodiaceæ ...	1	......	1	......	......	2
Phytolaccaceæ ...	1	......	......	......	......	1
Polygonaceæ	......	......	1	......	......	1
Santalaceæ.........	......	......	......	1	......	1
Urticaceæ	......	......	1	......	1	2
Gnetaceæ	......	......	1	......	......	1
Irideæ	......	......	......	1	......	1
Amaryllideæ	......	......	1	......	......	1
Liliaceæ	1	......	......	......	......	1
Commelinaceæ ...	1	......	......	......	......	1
Juncaceæ	......	......	1	1	......	2
Gramineæ	3	4	9	......	8	24
Filices	2	1	6	......	......	9
Totals	42	24	103	9	37	215

As regards the proportion in which the natural families of plants are represented in the Andean flora, the figures here given agree pretty well with results derived from other sources. The number of *Compositæ* amounts to nearly a quarter of the whole number of species, and this proportion seems to prevail throughout the temperate regions of South America. But the proportion in my list for the higher or alpine region is a full third of the whole, and, as far as I can judge, this is not far from the truth as regards the Andes of Peru and Bolivia. Weddell's 'Chloris Andina' is unfortunately incomplete, and it includes plants of the upper region throughout the entire range from Columbia to Chili, so that it does not allow of accurate comparison. In that work 478 species of *Compositæ* are enumerated, and in the second volume, including all the remaining *Gamopetalæ* and nearly all the *Polypetalæ*, he reckons about 700 species. The remaining phanerogams could scarcely amount to 400 species, so that the proportion of *Compositæ* must approach to that above mentioned.

Next to the *Compositæ* the grasses play the most important part in the Andean flora. In my list they amount to very nearly one eighth of the whole collection, and in the alpine region to one sixth. I am disposed to estimate the true proportion in this part of the range at about one tenth.

It is not to be expected that in so small a collection the number of species belonging to the less predominant groups should correspond nearly to the real proportions, yet on comparison with other materials I have been surprised to find a considerable amount of agreement.

The third place in my list, as in Weddell's work, is taken by the *Scrophularineæ*, which supply about five per cent. of the entire number of phanerogams, and the fourth by *Solanaceæ*, while *Cruciferæ*, *Caryophylleæ*, and *Leguminosæ* are each represented by 7 species, or one thirtieth of the whole number, probably corresponding nearly to the true percentage.

Conspicuous by its absence from my list is the family of *Cyperaceæ*. These are comparatively rare in the higher region of the Andes, and apparently almost altogether absent from the dry regions of Peru and Bolivia. *Primulaceæ*, which are such conspicuous ornaments to the mountain floras of the old world, are everywhere rare in America, and their absence is not a matter for surprise.

The most remarkable feature in the local flora of Chicla is the

presence of four species of *Crassulaceæ*, of which three appear to be new. The order is very sparingly represented in South America, and, so far as I know, no species of true *Sedum* has been previously recorded.

The figures in the foregoing list show a total number of 178 species collected in the temperate zone, and only 46 in the alpine zone; but they suffice, in my opinion, to prove that the flora of the western slope of the Peruvian Andes, and especially that of the temperate zone, is by no means so poor as has been hitherto supposed. It will be seen that after excluding the species introduced by man, and those subsequently found by Mr. Ward, I was able to collect 53 species by jumping from the train during very short halts between the levels of 7800 and 11,000 feet, and that 136 species were found in the immediate neighbourhood of the village of Chicla. The flora of the alpine region doubtless gave me the impression of poverty; but it must be remembered that the 46 species enumerated were all found within a very restricted area, presenting little variety of surface or exposition, and I am not sure that under similar disadvantages other high mountain regions would give a better harvest.

It is not easy to find published data for comparison. The results obtained in a district that has been fully examined by botanists having time for the purpose are, of course, misleading; while in short excursions one usually attends mainly to the new or rarer species, and overlooks the common and widely spread forms. The only materials I have found that in some degree admit of comparison with the results of my excursion to Chicla, are contained in the appendix to Hooker and Ball's 'Marocco and the Great Atlas.' In the valleys of Aït Mesan and Amsmiz we collected specimens of all, even the commonest species; and in the accompanying table the distribution of each, between a middle zone extending from the level of 1200 metres to that of 2000 m., and a superior zone reaching from 2000 to about 3500 metres, is exhibited. These zones correspond fairly well with what I have here distinguished as the temperate and alpine zones in the Andes, but the circumstances were in many ways different. In Aït Mesan we spent the greater part of six days; a much larger extent of ground was traversed, and in great part carefully examined by two botanists. Our collections there gave a total of 385 species of phanerogams and ferns, of which 283 species were found in the middle zone, and 154 in the superior zone, 52 species

being common to both. In the Amsmiz valley the conditions were more nearly similar, and afford better ground for comparison. In that valley we collected 225 species, 162 being found in the middle and 91 in the superior zone, 28 species being common to both zones. The opportunities for collecting in the middle zone were less than at Chicla, but much more favourable in the superior, as we were able to examine the ground rather closely in the course of an ascent and descent through a vertical height of more than 4000 feet. My general conclusion is that, as regards variety of vegetation, the western and most sterile slope of the Peruvian Andes is at least as rich as the northern slopes of the Great Atlas, and probably far superior to the southern slopes of that range *.

In considering the bearing of the facts here brought together on questions connected with the past history and origin of the

* Since the above lines were written I have had opportunities for comparing the results obtained in the Andes with those procurable under similar conditions in the Swiss Alps. During three days, between the 12th and 15th August, I noted all the species seen in flower or fruit above the Baths of Rosenlaui in the Bernese Oberland, between the levels of 4500 and 5200 feet above the sea, corresponding as well as I could estimate with the range of my short excursions from the village of Chicla. On the 2nd of August, I noted in the same manner the species observed in two separate areas above the summit of the Furca Pass, at about 8000 feet above the sea, the one slope facing south-west, the other nearly due north. In both the latter observations, while devoting about the same time that I was able to give in the Andes above Casapalta, I covered more ground, with the result of obtaining many additional species. The reason for omitting from my Alpine lists plants not seen either in flower or fruit is, that in the Andes I abstained from collecting plants which I should be unable to determine.

My Rosenlaui list includes 143 phanerogams and 7 ferns against 129 phanerogams and 7 ferns collected about Chicla; and it is worthy of note that in each list nearly three fourths of the phanerogams belong to the same natural orders. In the Furca lists the better exposed area afforded me 65 species, and the less favourably situated slope only 45 species, 30 species being common to both. Bearing in mind the fact that a larger area was in both cases examined, I came to the conclusion that, as regards the true alpine zone, the portion of the Andes seen by me supports a vegetation as varied as that of Central Switzerland; while as regards the subalpine region, the Alps display a somewhat more varied vegetation. The range of individual species appears to be decidedly greater in the Alps than in the Andes, as is shown by the fact that out of 80 species seen above the Furca Pass, growing on crystalline schists near the superior limit of vegetation, 18 species were found in the valley of Rosenlaui at a level lower by 2500 or 3000 feet, and growing on calcareous soil.

I have no doubt that on the southern side of the main chain the Alps usually exhibit a much more diversified vegetation.

Andean flora, it will be best to exclude altogether the ferns, as well as the species introduced by man. The 206 remaining species include representatives of 49 natural orders. Of these, five orders—*Passifloreæ, Bignoniaceæ, Nyctagineæ, Phytolaccaceæ,* and *Commelinaceæ,* each appearing only by a single species which does not rise above the level of 10,000 feet, are mainly inhabitants of the tropical zones of the Old and New Worlds. *Hydrophyllaceæ,* represented by one species, and *Polemoniaceæ,* by two species, are orders whose original home appears to lie in the north-western part of the American continent, and which are sparingly represented in South America. *Loasaceæ* alone, of which four species are enumerated in the following list, form a group which may be regarded as specially Andine. With the singular exception of the monotypic genus *Kissenia* in east tropical Africa, the other genera of this family, including about 100 species, appear to have all originated in the mountain regions of Central and Southern America, which I shall here designate as the Andes, using that term in a broad sense. Setting aside the somewhat doubtful representative of the small anomalous order *Datisceæ,* we find that 193 species in the annexed list belong to 40 natural orders, which are all very widely distributed throughout the world.

Descending from natural orders to the categories of suborder and tribe, we discover few indications of a special Andean flora. The genus *Balbisia* represents the small distinct Andean tribe of *Wendtieæ* belonging to *Geraniaceæ,* and *Malesherbia* belongs to a tribe of *Passifloraceæ* peculiar to the Central and Southern Andes. The genus *Calceolaria,* which by itself constitutes a tribe of *Scrophularineæ,* is represented at Chicla by five species; but there are very strong reasons for referring its origin to the Antarctic region rather than to the Andes. To many a botanist the most distinctive element in the Andean flora is afforded by the *Mutisiaceæ,* a tribe of the omnipresent *Compositæ,* which is not, indeed, confined to the South American continent, but which there finds its chief development, especially in the Chilian Andes. Of 57 known genera *, containing about 420 species, 42 genera and fully 350 species are confined to South America. The rest are scattered from South Africa to China, and only one American genus (*Trichocline*) is represented elsewhere, *i. e.* in Australia.

* Throughout this paper I have adhered closely to the limits of genera as defined in Bentham and Hooker's 'Genera Plantarum,' and in the following remarks I have applied the same rule in comparing my results with those of Weddell.

In attempting to speculate on the possible origin of this remarkable tribe the first difficulty is to answer the question, whether we should regard them as all descendants from a common ancestor. It is quite true that a complete natural arrangement, if such were attainable, would make community of descent the criterion for the establishment of genera as well as of larger groups; but it may well be doubted whether, in cases where a vast number of forms have been simultaneously developed by continually fresh divergences from one or a few ancestral types, it is possible to reconstruct the genealogical tree. In a remarkable paper, published in the Journal of this Society, Mr. Bentham explained the principles by which he was guided in arranging the *Compositæ* for the 'Genera Plantarum.' He must be a bold man who would, in the present state of our knowledge, undertake to improve upon Mr. Bentham's classification of the 780 genera and some 10,000 species that are already known of the vast family of *Compositæ*; but I think that in pointing out, as he has done, the complex affinities of the *Mutisiaceæ* with other tribes—*Cynaroideæ*, *Inuloideæ*, and *Senecionideæ*—he implied a doubt whether the plants which must under any logical plan of classification be ranked in the same tribe, may not have originated through very different lines of descent. It is impossible, for instance, to compare some species of *Trixis* with species of *Senecio* closely resembling them in habit, and differing only to a slight extent in floral characters, and to retain the belief that they have no nearer genealogical tie than that which may have existed between the ancestor of the Senecioids and that of the group including such remote forms as *Mutisia*, *Chuquiraga*, and *Nassauvia*. I venture to believe that under *Mutisiaceæ* are included plants originating in many very different lines of descent, but that among these there are some minor groups distinguished by high relative antiquity. That which includes *Barnadesia*, *Chuquiraga*, and *Mutisia* apparently had its origin in the high mountains of tropical South America; *Nassauvia* and a few allied genera may have arisen in the southern Andes, while *Trichocline*, *Chætanthera*, and some of their allies may perhaps trace their origin to an Antarctic home, whence the ancestor of *Gerbera* and a few other Old-World forms may have reached South Africa.

We have seen that, so far as the materials go, endemic natural orders and tribes do not appear to play an important part in the Andean flora. It is when we examine the smaller groups of genera and species that we perceive better the true character

of the flora. Of the genera in my list a full half, or 63 out of 122 genera, are *Cosmopolitan*, that is to say, are widely spread throughout the world, and extend to the temperate regions of the northern hemisphere, including Europe; and these 63 genera include 127 species or five eighths of the entire number. A small number of genera, which I have designated *Amphigean*, extend to the Old World, but have a limited distribution and do not reach Europe. Three genera (*Halenia*, *Castilleja*, and *Muehlenbergia*) are common to North America and to temperate Asia, and may for the present purpose be reckoned under the head of *American* genera, common to the northern and southern parts of the continent. Of these, including the three above named, I reckon 19 genera, to which belong 25 species. I next note six genera which are common to South America and the cooler extratropical regions of the southern hemisphere, and which I designate as *Antarctic* genera. These are *Calandrinia*, *Acæna*, *Oreomyrrhis* (or *Caldasia*), *Calceolaria*, *Ourisia*, and *Muehlenbeckia*, and are represented in my collection by 12 species. There remain the genera peculiar to the Andean region, using that term in a wide sense to include the highlands of Central America and Mexico, as well as those of Brazil and Venezuela. Of these, termed *Andean* genera, I reckon 27, including 32 species. It is thus apparent that, so far as regards genera, the flora of the Peruvian Andes is less widely separated from the rest of the world than has been commonly supposed, and it is only when we come to scrutinize the species that we find the local character of the vegetation strongly impressed. In fact, very nearly five sixths of the species are exclusively Andean, and of these, the majority appear to occupy only a limited area within that region. The subjoined table will exhibit more clearly the distribution of the species.

Table showing the relative Extension of the Area occupied by the indigenous Species of the Rimac Valley.

Genera.	No. of genera.	No. of Cosmopolitan species.	No. of American species.	No. of Andean species.
Cosmopolitan	63	9	18	100
Amphigean	7	......	5	5
American	19	......	6	19
Antarctic	6	......	......	12
Andean	27	......	... ..	32
Totals	122	9	29	168

In attempting to draw any conclusions from the materials at my disposal, I was naturally confronted with the doubt whether a collection so small could be regarded as in any degree representative of the Andean flora. Unfortunately we possess no complete work in which the existing materials for a flora of any part of the tropical Andes have been brought together. The 'Chloris Andina' of that excellent botanist the late Mr. Weddell unfortunately remains incomplete, and for purposes of comparison it is difficult to use, because it includes a large number of species confined to the Chilian Andes, and belonging to genera either not at all, or very slightly represented in the equatorial region. There is also some inconsistency in the limits of elevation assumed as characteristic of the Andean flora. I have attempted roughly to compare my results with those obtainable from the 'Chloris Andina,' and am led to the conclusion that they are more fairly representative than I could have anticipated.

The only large group as to which Weddell's work is complete is that of the gamopetalous dicotyledons, including the *Compositæ*. For the latter the inclusion by Weddell of a large number of genera and species of *Mutisiaceæ* which do not extend to the tropical Andes would make the comparison misleading; and for similar reasons I have restricted the comparison of the remaining natural orders of *Gamopetalæ* to the *Bicarpellatæ* as defined by Bentham and Hooker.

Tables showing Comparative Results as to two large Groups of Plants of materials in the 'Chloris Andina' *and in the Collection made in the Rimac Valley.*

Compositæ, excluding Mutisiaceæ.

	Chloris Andina.		Rimac Valley.	
	No. of genera.	No. of species.	No. of genera.	No. of species.
Cosmopolitan genera	10	214	9	33
Amphigean genera	2	18	2	2
American genera	6	43	4	7
Antarctic genera	2	3		
Andean genera	17	88	4	4
Totals...............	37	366	19	46

Bicarpellatæ.

	Chloris Andina.		Rimac Valley.	
	No. of genera.	No. of species.	No. of genera.	No. of species.
Cosmopolitan genera	19	154	10	24
Amphigean genera	1	6	1	1
American genera	8	28	10	10
Antarctic genera	2	46	2	6
Andean genera	18	39	4	4
Totals.................	48	273	27	45

Allowing for the numerous circumstances leading to discrepancies in the results of such a comparison, the figures given above show a remarkable amount of agreement, and lead to the inference that (when the special elements of the Chilian flora are excluded from consideration) the small collection made by me is fairly representative of the general character of the flora of the Peruvian Andes. I have therefore thought it worth while to consider what indications it may afford to elucidate the problems of the past history of the South-American flora, availing myself where possible of the fuller materials supplied by the 'Chloris Andina.'

The first fact which must be taken into account is the preponderance in this flora of types that are very widely, almost universally, diffused throughout the world. It has been already pointed out that nearly nineteen twentieths of the species (193 out of 206) belong to 40 natural orders that are found in almost all the mountain-regions of the world. Comparing the flora of New Zealand, as one of the most distinct and isolated, I find that only two of the above 40 orders, *Capparideæ* and *Asclepiadeæ*, are wanting in that region. I further note that (omitting *Datisceæ*) more than 60 per cent. (126 out of 206) of the species in my collection belong to 62 cosmopolitan genera, many of which have a range nearly as wide as the natural orders to which they belong. These proportions would doubtless have been somewhat altered if I had been able to collect more largely in the higher region. I should have added largely to the number of generic types

peculiar to the Andes, but the proportion of species belonging to cosmopolitan genera would not probably have been very much reduced. I have tabulated the proportions found in the 'Chloris Andina' for genera and species belonging to the gamopetalous dicotyledons which here constitute about one half of the entire phænogamous flora.

Analysis of the Genera and Species of Gamopetalous Dicotyledons in the Andean Flora.

	Number of genera.	Number of species in Andean flora.
Cosmopolitan genera	34	422
Amphigean genera	5	50
Wide-spread American genera...	17	76
Antarctic genera	6	57
Andean genera	62	274
Totals	124	879

It will be recollected that this table includes a large proportion of the Chilian flora, in which the endemic elements are much more strongly marked than in the Equatorial Andes. Yet even here, we find nearly one half of the species belonging to 34 cosmopolitan genera, a full third being supplied by the 6 genera *Valeriana*, *Gentiana*, *Bartsia*, *Erigeron*, *Gnaphalium*, and *Senecio*; while much less than a third of the species are ranked under the 62 endemic genera of the Andean flora.

I may here remark that, so far as the available materials admit of comparison, the Andean flora appears to be one of the most distinct existing in the world, if we take the proportions of endemic genera and species as criteria. It would appear that about one half of the genera and fully four fifths of the species are limited to that region, showing a degree of separateness scarcely surpassed elsewhere. Allowing for the fact that the endemic elements of the flora of each large region are more conspicuous in the mountains than in the low country, it is remarkable that, comparing the same large group of *Gamopetalæ* in the Australian and Andean floras, we find in the first only 97 endemic genera out of a total number of 353, while in the latter one half of the genera are endemic.

The fact, which I take to be beyond dispute, that in all the mountain-regions of the earth a comparatively small number of the same vegetable types form prominent, if not predominant, elements in the existing floras, seems to me strong evidence of their great antiquity, even as geologists use that term. Of many of them it may be asserted that they possess no special facilities for transport over wide areas of ocean, and it must be remarked that, while in the large majority of cases genera thus widely diffused are represented by species differing widely in structure, we yet find that in cases where the diffusion appears to have occurred in recent geological times, the species themselves have remained unaltered, and scarcely exhibit the amount of change which botanists designate by the term variety. As compared with the historical period, the separation of the British Islands from Northern and Central Europe is an event of high antiquity, though recent in a geological sense. Many species have been exposed to new conditions since that date; but not a single new species, scarcely even a well-marked variety, has been developed during the interval.

I trust that I shall be forgiven if in spite of the great authority attaching to the name of Sir Joseph Hooker, who in this matter has been followed by Mr. Wallace, I prefer to designate as *Cosmopolitan*, rather than *Scandinavian*, the types of vegetation of which the only fact certainly known is that they are widely spread throughout the world. In the present state of our knowledge it is, I think, impossible to form any safe conjecture as to their origin, but there appear to be strong reasons for attributing to them a high antiquity. As to some of them, there are grounds for supposing that the colder North Temperate Zone was, if not their original home, the region from which they have migrated in recent times; but of these many may, with more reason, be referred to North America than to Scandinavia, while as to many others the balance of evidence points to an original home in the high mountains of lower latitudes.

The constituents of the Andean flora furnished by the genera which I have called *Amphigean* do not demand detailed discussion in this place. Only five or six per cent. of the vegetable population belong to this class; they belong chiefly to families that are common to the Old and New Hemispheres, but which do not extend far beyond the tropics. Any explanations that can be offered as to their origin must be, to a large extent, con-

jectural, and in each case should be considered separately with reference to the facts of its distribution and its structural affinities.

The class which I have designated *American* genera, including those which are widely spread through both portions of the continent and, with the exception of a few representatives in North-eastern Asia, do not extend to the Old World, forms a considerable, though not a preponderant, constituent in the Andean flora. When we consider that, although subsidence has probably at various times separated the two portions of the continent, the highlands of Mexico and Central America have, in all probability, served during long periods as a bridge over which some portions of the mountain vegetation may have been transferred from North to South and *vice versâ*; we are led rather to feel surprise at the amount of separateness now existing than at the presence of many genera and of a few identical species in the floras of the Andes and that of the Rocky Mountains. It is true that I have reckoned as Andean genera and species many that extend northward as far as Mexico, and it may well be that that region, so rich in varied forms of vegetation, is the original home of some that now appear to be more fully developed in the mountain ranges of Western North America. Among the wide-spread American types we must note two natural orders whose original home may, with some confidence, be placed in the north-western part of the continent. The *Polemoniaceæ*, of which about 140 species belong to that region, are represented in the Andes by five species of *Gilia*, one of *Collomia*, and by the endemic genus *Cantua*. They have sent to the Old World two or three species of *Phlox* in Northern Asia, and a single emigrant which has reached Britain, the Jacob's Ladder of old-fashioned gardens, which maintains a struggling existence in several isolated spots in Europe. The other specially American family is that of the *Hydrophyllaceæ*, of which 12 genera are known in North America, but which is represented in the Andean chain only by four species of *Phacelia*. An opposite phenomenon is presented by the natural order of *Loasaceæ*, which we may, with much probability, hold to have had its origin in the mountain regions of South America. The genus *Mentzelia*, which extends in South America from the plains of Patagonia through the temperate zone of the Andes, must at some remote period have travelled northward to Mexico, and thence to temperate North America. It has there

developed several distinct species, one of which, at least, has spread northward into British North America.

Among the *American* genera that are conspicuous in the Andean flora one of the most interesting is *Baccharis*. Among some 280 described species which are scattered over every part of South America, from the Straits of Magellan to the equatorial zone, and which extend on the west side of the continent to California and Nevada, we find a surprising variety in habit and in the form and arrangement of the vegetative organs, along with a remarkable amount of uniformity in the reproductive organs, which are constantly diœcious. I confess that the arguments that have led some distinguished botanists to consider the great family of *Compositæ* as of comparatively recent origin appear to me altogether inconclusive. When I consider the vast variety of forms which it includes, the degree in which some large groups are localized in different regions of the earth, while others, such as *Senecio*, have representatives in every zone, I shrink from the conclusion that their origin can be, even in geological language, at all recent. It is, of course, not inconceivable that plants which we class together under the name *Compositæ* may have come into existence by different lines of descent through gradual modification from different ancestral types; but when we consider the general agreement in the structure and arrangement of the essential organs, I think that the balance of probability inclines decidedly towards the belief in a community of origin of all the various existing forms. Be that as it may, we are, I think, justified in looking to the mountain regions of South America as the original home of many large groups, such as the genus *Baccharis*, most of the *Mutisiaceæ*, and many genera of other tribes.

I could not fail, while travelling in South America, to reflect on the probable origin of the types of vegetation which are common to that portion of the continent and to distant spots in the southern hemisphere, separated by wide expanses of ocean. The connection between these distant floras is proved by the presence of closely allied, and even of some identical species, belonging to genera not known elsewhere in the world, and extends to many forms that do not appear to be provided with special facilities for transport to a distance.

I was struck by several considerations which concur in indicating the same probable explanation of these remarkable facts.

We know that at a recent geological period, and very probably at many preceding periods, the climate of the northern polar regions was so far different as to favour the growth of plants now characteristic of the warm temperate zone. Whatever may have been the causes of such a change in the distribution of temperature, it is contrary to all analogy to assume that in the long record of the vicissitudes in the condition of our planet similar causes have not produced effects in some degree similar in the southern hemisphere. Further than this, our limited knowledge of the geology of the southern hemisphere suffices to show that most, if not all, portions have undergone very great oscillations of level, involving as a necessary consequence alternate extension of the areas of land and ocean.

The difficulties of antarctic navigation have, unfortunately, hitherto limited our knowledge of the south polar regions; and, while many believe that a considerable continental area, wholly or in part covered with perennial snow or ice, now surrounds the southern pole, other geographers, with whom I am disposed to agree, think it more probable that the south polar lands constitute a great archipelago formed by numerous islands, some of which are probably of great extent. Whatever may be the fact at the present time, there is a strong probability that, in the course of past changes of temperature and level, a mild climate and an extensive area of Antarctic land may once, or very possibly many times, have occurred simultaneously.

Here, at a period remote even in geological language, we should look for the original home of those types of vegetation which we designate as Antarctic. In opening a new region for habitation to a comparatively few vegetable ancestors, the favourable conditions for the development of new generic types were provided, and the process would have been hastened by the frequent vicissitudes of temperature and moisture to which the climate of such a region must have been subjected.

I was altogether unconscious that in following this train of speculation I was merely developing a suggestion contained in the 12th chapter of the 'Origin of Species' *, which had failed

* The passage, which has only very recently been recalled to my recollection, runs thus:—"This difficulty almost disappears on the view that New Zealand, South America, and other southern lands were long ago partially stocked from a nearly intermediate, though distant point, namely, from the Antarctic islands, when they were clothed with vegetation, before the commencement of the Glacial period."

to impress itself upon my memory when originally presented to it, and I further find that the same view has since been defended by Mr. Wallace in his remarkable work on 'Island Life,' and still more recently by Professor Engler. If I have rightly apprehended the brief statement of his views given by Mr. Wallace in pages 489 and 490 of the work above cited, they do not completely accord with the conception that seems to me best to account for ascertained facts; and I may here specify the points of difference. Mr. Wallace regards the peopling of the Antarctic lands with their characteristic generic types as a comparatively recent event. He supposes that those already existing types were carried southward from South America, or other circumpolar countries, to a preglacial Antarctic continental region, and having there spread widely, were thence conveyed northward to the widely scattered islands where they still survive. To me it seems much more probable that the origin of the special generic types of the Antarctic flora should be referred to the Antarctic region itself. They belong, without exception, to the great groups or natural orders which are now almost universally diffused throughout the world; and the ancestral types from which they originated were probably carried to that region at a remote period when the physical conditions of the earth's surface were widely different from those now prevailing. Their present distribution points rather to migration from a higher latitude to their present homes, than to transport in an opposite direction. On large continents where no barriers, such as wide deserts or high mountain-chains, intervene, the diffusion of plants occurs most easily in directions between east and west, because the climatal conditions are more nearly uniform. But the reverse obtains where the transport takes place across wide spaces of ocean. The two chief agents are ocean-currents, with or without floating ice, and migratory birds; and, speaking generally, the predominant direction in which these travel approaches to the meridians of longitude.

I may here venture to express the belief that the efficacy of winds as agents for the dispersal of plants over wide ocean spaces has been considerably overrated. We know that the spores of cryptogams may be conveyed for indefinite distances by aërial currents; but the seeds of flowering plants are immeasurably heavier; and I am not aware of a single fact that authorizes us to infer that mode of transport over wide intervals of ocean as

efficient in the present condition of things. No doubt tornadoes carry many seeds to considerable heights, and if they travelled far with currents of equal violence, might carry them across spaces of many hundred miles in width; but, if at all, such a possibility can scarcely exist in temperate latitudes. If winds were efficient for the purpose, I feel sure that we should find evidence of the fact in the much wider oceanic distribution of species having small seeds or winged appendages.

On the other hand, it appears to me that Mr. Wallace has not sufficiently dwelt on the predominant influence of migratory birds in the dispersal of plants, where physical obstacles prevent their gradual diffusion. If it be true that many facts of distribution may possibly be accounted for by ocean-currents carrying floating timber or ice-rafts laden with soil, it remains true that most of these facts are at least equally well explained by the intervention of birds; whilst for numerous other facts transport by birds affords the only probable explanation. I do not know whether it has been remarked that, as between regions in the temperate zone and others nearer to the pole, the chances of the transfer of species by birds from higher to lower latitudes is very much greater than in the opposite direction. As a rule, birds winter in the milder climate and resort to higher latitudes in spring or early summer*. In autumn, when seeds and fruits are mature, they carry them to a milder region, where, under favourable conditions, these may establish themselves. If we admit the probability of an Antarctic centre of distribution for the types of vegetation which we are agreed to call *Antarctic*, but suppose those types to have originally reached the Antarctic region from South America or Australia, we find it very difficnlt to conceive the means by which they could have reached the polar continent; while if that continent were their original home there is no difficulty in understanding their subsequent diffusion in a northerly direction.

It may be reasonably objected that a similar argument might be urged against the primitive peopling of an Antarctic continent by the ancestors whence the special Antarctic genera must have been derived; and the answer to this objection requires a very

* Professor Giglioli has called my attention to the fact that some birds migrate from low latitudes in summer to higher latitudes in winter. Such cases are rare and exceptional, but they may serve to explain some anomalous facts of plant distribution.

brief discussion of the reasons which go to prove the remoteness of the period at which the original colonization of the Antarctic region must have occurred. The undoubted fact of the diffusion throughout the world of those natural groups of plants which I have called cosmopolitan leads directly to the conclusion that their diffusion must have been effected at a period when either the relative distribution of land and sea must have been widely different, or when the physical conditions of the earth's surface were quite other than those now prevailing. Accepting, within moderately wide limits, the doctrine of the permanence of continental areas, I cannot resort to the first alternative, and I see in the second the more probable explanation. The skill and energy with which the doctrine of the uniformity of physical conditions of the earth's surface during past geological periods has been advanced by eminent modern authorities has gone far towards obtaining general assent; but I cannot believe that it will maintain its ground against the stringent arguments with which it has been met by physicists and astronomers. Allowing a considerable margin for the action of modifying causes, it seems impossible to doubt that, at a period not very remote in a geological sense, the temperature of the earth's surface was sensibly higher, the difference between polar and equatorial temperature greater, and in consequence the currents both of the air and ocean more rapid. Along with this the action of the tides was far more violent, and the inequalities of the earth's surface more considerable. The relief of the surface at any given period represents the sum of the results through previous ages of two sets of opposing forces—those of upheaval, and those which lower eminences and fill up depressions. Chief amongst the former is contraction of the earth's crust through gradual cooling; and this must necessarily have been more efficient in the earlier stages of the earth's progress, while at a later period the levelling forces have gradually assumed a supremacy which they obviously possess at the present time.

Various considerations tend to the conclusion that the dispersal of the chief cosmopolitan genera of plants may have coincided with the period of the deposition of the older Secondary rocks, and at that period physical agencies far transcending those of our experience prevailed throughout the earth. If the ancestors of the Antarctic types of vegetation were then established in a south-polar continental area, and were developed from them by

gradual modification, I see no difficulty in believing that they may have maintained themselves through successive gradual changes of physical conditions within the same region, and even that some may still survive within the Antarctic Circle. This conjecture presented itself forcibly to my mind when passing some days in midwinter at Sandy Point in the Straits of Magellan. Many delicate plants, impatient of sharp frosts, maintain themselves there in the same latitude with not distant places, such as South Georgia, which are almost completely covered with permanent snow. The reason is sufficiently obvious. The accumulation of snow or ice taking a permanent form occurs only where the supply, by precipitation or condensation, exceeds the amount annually melted, and this is limited to special portions of the earth's surface, usually to high lands, exposed to moist currents from the sea*.

Having considered the constituents of the Andean flora which have most probably been derived from other regions of the earth, I may briefly notice the remaining types which are peculiar to this part of the earth. From the figures given in the preceding pages we are led to conclude that the large majority of the species and about one half of the genera of the Andean flora are not known elsewhere. Of these endemic species and genera the majority are allied to the cosmopolitan types to which I have so often referred, and extend northward to Central America and Mexico. Others, and especially the genera which exhibit less affinity to types known elsewhere, are confined to the proper range of the South-American Andes, and some of them to a small portion of the range. We find in these facts reason to believe that, while South America has from a remote period been able to receive occasional colonists from the north, there has been a very long period of relative isolation during which a large number of separate species, and not a few genera, have been differentiated. As to some groups at least, such as the *Loasaceæ*, many *Mutisiaceæ*, and others where the structure has been profoundly modified, we must allow a very long interval for changes so considerable. If it be objected that we have reason to believe the elevation of the Andean chain to be a comparatively recent geological event, I would reply, in the first place, that there is no reason to suppose

* This is not the place to discuss the views which Dr. James Croll has maintained with singular ability and a wide grasp of the facts and principles of physical science. I find it impossible to accept his theory of a polar ice-cap and the important consequences which he derives from it.

the great movements of alternate elevation and depression to have been nearly contemporaneous throughout the vast length of that range, and that it is more probable that some portions remained as lofty mountain-masses, while others were nearly or altogether submerged. This remark applies especially to the highlands of Bolivia and Peru, where the Palæozoic rocks do not appear to be overlain by recent marine deposits.

Whether this view be valid or the reverse, we must, I think, look to an adjoining region as the original home of the majority of the special forms of vegetation that are now limited to South America, as well as of many others that have spread more or less widely to other parts of the earth. In a zoological as well as a botanical sense Brazil is one of the most distinct and separate regions of the earth. It is, in large part, a granitic region, from which vast masses of superincumbent strata have been denuded, and where the granite itself has undergone a great amount of decay and ablation. We there see the ruins of one of the greatest mountain-masses of the earth, where a very ancient fauna and flora were developed, of which portions were able to migrate to a distance, while others have been modified to adapt themselves to the gradual changes of the environment. Many vegetable groups which are but slightly represented in the higher region of the Andes, but which doubtless originated in South America, such, for instance, as the *Melastomaceæ*, probably had their origin in the mountains of ancient Brazil.

If in the foregoing pages I have omitted to notice and discuss the views of Professor Engler, expressed in his important work 'Versuch einer Entwicklungsgeschichte der Pflanzenwelt,' it is because I felt that such a discussion would outgrow the proper limits of the present paper. Agreeing in several of Professor Engler's hypothetical views, and entirely dissenting from others, I could not do justice either to him or to myself without an amount of detail which would be altogether inappropriate.

List of Plants collected in the Upper Valley of the Rimac in the Peruvian Andes.

Ranunculaceæ.

Clematis peruviana, *DC., Syst. Nat.* i. 141, var. andina, *nob.*

Differt a typo sepalis longioribus acutioribus, foliis magis dissectis. Chicla!

The description of this species above cited is fuller and more accurate than that subsequently given in the 'Prodromus,' but does not represent the ordinary form. It was drawn up from specimens in the Paris Museum collected by Dombey in Peru, and would appear to have much smaller flowers than I find in the numerous specimens existing in the Kew Herbarium. DeCandolle's words are, "sepala patentissima ovato-oblonga acuta staminibus duplo fere breviora;" whereas, in what I presume to be the ordinary form of the species, the sepals are about once and a half the length of the stamens, and are often somewhat reflexed when in full flower. The Chicla plant, which apparently inhabits a higher zone than any of the other specimens I have seen, is extremely ornamental, the large crowded flowers, of a delicate sulphur-yellow, often completely concealing the bushes over which the plant climbs. The leaves and petioles are slightly pubescent, but the broadly ovate, entire, or slightly toothed bracts, 2 or 4 in number, which form a detached involucre about the middle of the one-flowered peduncle, are covered with soft villous hairs. The leaves are much divided, bipinnatipartite, with stalked three-lobed pinnules.

Thalictrum podocarpum, *H. B. K.* Chicla! This recalls the appearance of the rare Pyrenean *T. macrocarpum.*

Ranunculus chiclensis, n. sp. Chicla, in moist ground!

Bipedalis et ultra, indumento totius plantæ e pilis subadpressis hirtulo; radice e fibris validis subincrassatis; foliis radicalibus et caulinis inferioribus pinnatisectis; pinnis alternis trisectis vel pinnatifidis, superioribus oblongo-cuneatis varie incisis; floribus majusculis longe pedunculatis; petalis 5-10 angustis oblongo-cuneatis, apice truncatis vel leviter emarginatis, lineis tenuibus obscuris notatis; acheniis compressis acute carinatis, in rostrum longiusculum, sæpe nec semper recurvum, sensim angustatis.

A very distinct species, especially remarkable for the form of the petals.

CRUCIFERÆ.

SISYMBRIUM MYRIOPHYLLUM, *H. B. K.* Valley of the Rimac, ascending from about the level of 9000 feet to Chicla!

SISYMBRIUM TITICACENSE, *Walp. Rel. Meyen. in Nov. Act. Acad. Leop.-Carol.* xix., *Suppl.* 1, p. 249. Above Casapalta, about 14,300 feet! The stems are 1–1½ foot long, prostrate or suberect, branching from below. The length of the siliqua seems to be variable in this group, and I doubt whether *S. athrocarpum*, A. Gray, U. S. Expl. Exped. i. 59, tab. 3, can be maintained as a distinct species.

SISYMBRIUM HIRSUTUM, *Planch. et Triana, DC.* (*sub* Turrite). Chicla! Upper Rimac valley, about 10,000 feet!

DRABA SILIQUOSA, *Hook. fil.* Chicla! Above Casapalta!

CAPSELLA BURSA-PASTORIS, *DC.* In many places about Chicla! This is one of the species that seem to owe their wide-spread diffusion in most regions of the earth to the agency of animals, and at the same time to their capability of adaptation to very different physical conditions. I have met with it in stations to which the seeds must apparently have been carried by birds; but for its original introduction in some remote regions it may be presumed that the unintentional interference of man is responsible. Such an instance is to be found in the Straits of Magellan, where I found it rather common and still flowering in midwinter about Sandy Point.

LEPIDIUM VIRGINIANUM, *L.* Upper valley of the Rimac!

LEPIDIUM AFFINE, *Wedd. in Ann. Sc. Nat.* ser. 5, i. 284, var. Chicla!

LEPIDIUM HUMBOLDTII, *DC.* Chicla!

CREMOLOBUS PINNATIFIDUS, *Hook. Ic. Pl.* 100, = C. parviflorus, *Wedd. in Am. Sc. Nat.* ser. 5, i. 283, = C. aphanopterus, *A. Gray, U. S. Expl. Exped.* i. 55. Chicla! The breadth of the wing of the silicule in this and the allied species is extremely variable, and without a series of connecting forms the identity of the above-named species might well be doubted. Some of my specimens are exactly A. Gray's *C. aphanopterus*, while others can scarcely be distinguished from Hooker's type specimens of *C. pinnatifidus*. I may here point out the necessity for suppressing the name of

another species in this genus. *Cremolobus rhomboideus*, Hook. Ic. Pl. 32, and *C. sinuatus*, Hook. Ic. Pl. 99, are both founded on specimens sent by Jameson from the Cuesta de Purruchuco in Peru, and an examination of the original type shows clearly that they are forms of the same species. *C. sinuatus* is founded on a depauperate specimen in which the silicules are quite wingless.

Capparideæ.

Cleome chilensis, *DC.* Upper Rimac valley, near Matucana, *R. Ward.*

Polygaleæ.

Monnina obtusifolia, *H. B. K.*, var.? Chicla! This plant belongs to a group which demands the careful study of all the available materials. My plant appears to be exactly the same as two unnamed specimens in Herb. Kew collected by Mathews in Peru near Chachapoyas, and numbered 1517 and 1518. To the same species must also, I think, be referred his number 3024, also from Chachapoyas. The latter is attached to the same sheet with a specimen labelled *Monnina pubescens*, H. B. K.?, but cannot be referred to that species. My plant is evidently nearly related to *M. obtusifolia*, H. B. K., and *M. crassifolia*, H. B. K.; and I provisionally rank it as a variety of the former.

Caryophylleæ.

Lychnis chilensis, *Naud. in C. Gay, Fl. Chil.* i. p. 256, var. peruviana, nob. Chicla! This belongs to a group of forms, all nearly allied to the Arctic *L. apetala*, L., which extend in S. America from the equator to the Straits of Magellan. From a cursory examination of numerous specimens, I am led to conclude that they may best be reduced to three species, as follows:—

1. *L. thysanodes*, Hook. fil., Fl. Antarct. ii. p. 246, = Silene thysanodes, *Fenzl.*, in Endl. Nov. Stirp. Dec. No. 39, = Silene andicola, *Gill.*, in Hook. Bot. Misc. iii. p. 147. *Melandryum cucubalodes*, Fenzl., quoted by Grisebach (Pl. Lorenz. p. 28), probably belongs also to this species; but I am unable to identify it with certainty.

This has relatively broad leaves; the stems usually have many flowers, which are drooping before fertilization. The calyx is rather less deeply cleft than in the following species, and the outer nerves of each of the adnate segments forming the calyx-

tube are confluent about halfway. It has been found at several stations in the Andes from Ecuador to Central Chili.

2. *L. chilensis,* Naud. l. c.,=L. terminalis, *Naud.*, in Fl. Chil. i. p. 255,=L. nubigena, *Phil. MSS.* This has very narrow stem-leaves, stems usually simple, one-flowered, calyx divided to about half its length, the outer nerves of each segment confluent near the base, the alternate stamens adnate to the base of the petals, the filaments ciliated, and angular seeds. To this I refer many Chilian specimens, as well as mine fram Chicla, and No. 989 of Mandon's "Bolivian Plants," although the latter are in some respects intermediate. This approaches more nearly to *L. apetala*, L., than either of its allies.

3. *L. magellanica,* Lam. Distinguished by its very narrow stiff leaves, incurved at the edges when the plant is mature, and the comparatively large flower.

Cerastium glomeratum, *Thuil.* Forma sepalis angustis acutis. Chicla; perhaps introduced!

It is, I think, time for botanists to free themselves from the servitude of adhering to a Linnean name when the object to which the name properly belongs is involved in confusion, and the practice serves only to prolong profitless controversy. Every one knows what is meant by *Cerastium glomeratum*, Thuil., but who is quite sure as to *C. vulgatum*, L.?

Stellaria leptopetala, *Benth. Pl. Hartw.* p. 163. Chicla!

Stellaria media, *Vill.* Frequent about Chicla! I much doubt the presence of this species in distant regions being due to the agency of man.

Arenaria Alpamarcæ, *A. Gray, Bot. U. S. Expl. Exped.* i. p. 114. Above Casapalta! This very much resembles *Colobanthus subulatus*, Hook. fil.

Drymaria nitida, n. sp. Chicla!

Herba annua, pumila, glaberrima, e basi ramosa, ramis suberectis 3–6-pollicaribus; foliis late elliptico-ovatis, apice acutis vel brevissime cuspidatis, sessilibus, integerrimis, subcarnosis; stipulis minimis, setaceis, fugacissimis; cymis terminalibus, parvis, densis; floribus breviter pedicellatis, virgineis nutantibus; pedicellorum bracteis parvis, ovatis, scariosis; sepalis late ovatis, obtusiusculis, concavis, eveniis, demum purpurascentibus; petalorum laminis in unguem tenuem angustatis, profunde fissis;

capsulis subglobosis, oligospermis. Semina in exemplaribus nostris immatura.

I have not seen authentic specimens of *D. divaricata*, H. B. K.; and from the description in the 'Synopsis Plantarum Æquinoctialium' one is led to suppose that it is nearly allied to the common *D. cordata*, Willd. But the species is said to inhabit the coast of Peru near Lima; and specimens in Kew Herbarium of a plant differing widely from *D. cordata*, collected near Lima and at Lurin in the same region, have been (probably correctly) named *D. divaricata*, H. B. K. This is the nearest ally of my Andean plant; but is more than twice as large, with laxer inflorescence, acute sepals, and the petals much larger and broader and less deeply divided.

D. glaberrima, Bartl., in Rel. Hænk. ii. p. 7, differs from *D. nitida*, among other particulars, in having petiolate leaves, and the cymes of flowers on long axillary peduncles. Specimens collected by Mathews "in moist places, Huamantanga," in Peru, were, I think, correctly referred by Planchon (in Herb. Kew) to *D. glaberrima*, though differing in some respects from Bartling's detailed description. The Galapagos plant, referred by Hook. fil., in Trans. Linn. Soc. xx., to *D. glaberrima*, differs more widely from Bartling's description.

DRYMARIA LEPTOCLADOS, *Hemsl. Diagn. Pl. Nov.* i. p. 2; *Biol. Centr.-Amer.* i. p. 74, tab. 3, var. *peruviana*, nob.? Chicla! A minute plant scarcely 3 inches high, with cuspidate leaves ending in a sharp point, scarious bracts tapering to a long acuminate point, with a green midrib, and a few subsessile flowers in a congested cyme. It is certainly nearly allied to the Mexican species above quoted, to which I think must also be referred No. 950, Mandon's 'Plants of Bolivia.'

PORTULACACEÆ.

CALANDRINIA CAULESCENS, *H. B. K.* Chicla!

CALANDRINIA ——? Chicla? Possibly a dwarf variety of the last, or an undescribed species. It is less than half the size of *C. caulescens*; and I did not notice any intermediate forms; but I have not detected any further differences.

CALANDRINIA ACAULIS, *H. B. K.* Above Casapalta!

MALVACEÆ.

MALVASTRUM LIMENSE = Malva limensis, *L.* Chicla! Also in the upper valley of the Rimac!

Malvastrum peruvianum, *A. Gray, Bot. U. S. Expl. Exped.* i. p. 146. Frequent in the upper Rimac valley, ascending to Chicla!

Malvastrum capitatum, *Griseb. Pl. Lorentz.* p. 42,=Malva capitata, *Cav.* Upper valley of the Rimac ascending to Chicla!

Malvastrum —— ? I collected in the upper valley of the Rimac, at between 9000 and 11,000 feet above the sea, two plants which, though differing in some respects, must be referred to the same species. The flowers are in dense glomerules on axillary or terminal peduncles, with no indication of the secund inflorescence so characteristic of *M. peruvianum.* The leaves are three-lobed, and the lobes more deeply and sharply toothed than is usual in that species. As Grisebach has remarked, *M. peruvianum* is an eminently variable species; and probably my specimens should be referred to it. However that may be, I am inclined to think that a plant in the Kew Herbarium labelled "*Malvastrum,* n. sp., No. 90, Parry and Palmer, 'Plants of Central Mexico,'" is not distinct from my plant.

It is remarkable that although I collected six species of *Sida* in the lower valley of the Rimac, none of these were seen to ascend above the level of 6000 feet.

Geraniaceæ.

Geranium sessiliflorum, *Cav.* Chicla! A dwarf form, much crowded, with short petioles, above Casapalta!

Erodium malacoides, *Willd.* Rimac valley above Matucana, about 9000 feet! Doubtless introduced.

Erodium cicutarium, *Willd.* Extremely common in the upper valley of the Rimac and about Chicla, ascending to the level of at least 12,500 feet!

The wide extension of this species in South America is very remarkable, especially as it has not shown the same readiness to establish itself in North America. In Chili, in Argentaria, and in North Patagonia it has spread throughout the low country; and it has been observed that it appears to follow domestic animals rather than man, not being seen at new stations in the interior until cattle have been driven there. Its fre-

quency in the Peruvian Andes, or at least in the district visited by me, is less easy to account for. So far as I know, it has not been found on the coast, or in the lower valley of the Rimac. Doubless many articles from the United States, as well as provisions from the neighbourhood of Lima, were carried up during the construction of the railway; but this does not much help us to explain the appearance of the plant. If we conjecture that seeds may have been carried in hay from Chili for the use of the Chilian force stationed at Chicla, it is scarcely conceivable that in a single year the plant could have spread as it has done, ascending steep rocky slopes inaccessible to horses.

TROPÆOLUM TUBEROSUM, *Ruiz & Pav.* About the Puente Infernillo, 11,000 feet! Chicla! One of the ornaments of the Andean flora; formerly cultivated by the Indians.

BALBISIA VERTICILLATA, *Cav.* Rimac valley above Matucana; flowering in May. *Coll. R. Ward.*

OXALIS FILIFORMIS, *H. B. K.* Chicla!

OXALIS PUBESCENS, *H. B. K.*, var. *glabra*? I found this *Oxalis* near Chicla, and also near the Puente Infernillo, about 11,000 feet above the sea! The latter is a larger plant, with erect stems branching from the base; but except in being quite glabrous, I observe no characters by which to distinguish them from *O. pubescens* But the South-American species of *Oxalis* are extremely embarrassing to the systematic botanist, very many species having been described of which specimens are not to be found in the chief European herbaria. The group with fleshy stems and leaves, to which *O. pubescens* belongs, is the more difficult that in drying the plant falls to pieces, as I found to be the case both with this and the following species.

OXALIS ——? Common in the crevices of rocks about Chicla! I have seen nothing in herbaria that seems to be nearly allied to this plant, but am unwilling to describe it as new. The rather large golden flowers are solitary, on short peduncles, which, like the leaves, spring from the crown of the thick fleshy root (or rhizome), which extends deep into the crevices of the rocks.

Leguminosæ.

Lupinus paniculatus, *Desr.*, var. argenteus. This is the dominant social species about Chicla, covering the steep slopes in many places up to a level of about 12,500 feet!

Lupinus microphyllus, *Desr.*, var. argyreius, *nob.*? Above Casapalta, about 14,300 feet! A dwarf plant, with decumbent branches, 3 or 4 inches in length, the leaves, and especially the calyx and bracts, covered with silky hairs, the petiole twice or thrice as long as the seven narrow leaflets. The immature legume appears to be broader and less pointed than in the true *L. microphyllus.* The same plant was collected by Mathews at Chachapoyas, bearing his number 1570, and may perhaps deserve to rank as a separate species.

Medicago denticulata, *Willd.* In the upper Rimac valley, between 9000 and 10,000 feet; not uncommon, but doubtless introduced!

Melilotus indica, *All.*=M. parviflora, *Desf.* In the valley of the Rimac, ascending above the level of 9000 feet. Doubtless introduced!

Trifolium amabile, *H. B. K.* Chicla! This differs a little from the ordinary form in having the petioles hairy, and the peduncles clothed with short adpressed hairs.

Trifolium amabile, *H. B. K.*, var. Pentlandi, *nob.*? Chicla!
Differt a typo hirsutia totius plantæ, ramis brevibus prostratis, pedunculis axillaribus brevissimis, calycis dentibus brevioribus, tubo quam in typo longiore.

The same plant was collected by Pentland near the lake of Titicaca. It may be the same as *T. peruvianum*, Vog. Walp. Rep. i. p. 644, of which I have seen no authentic specimen, or may rank as a distinct species; but provisionally I prefer to place it as a variety of *T. amabile.*

Trifolium chiclense, n. sp. Found sparingly near Chicla!
Perenne, e collo radicis crassæ lignosæ ramos plurimos breves prostratos edens; foliis apicem versus ramorum confertis, longiuscule petiolatis, petiolis sparsim pilosis, foliolis glabris late obovato-cuneatis argute serrulatis; stipulis lineari-lanceolatis, acuminatis; capitulis 4–8-floris, subsessilibus, versus basin ramo-

rum approximatis; calycis dentibus triangulari-lanceolatis, tubo brevi longioribus; vexillo brevi calycem parum superante; legumine dispermo.

A *T. amabili*, florum structura affini, differt imprimis calycis tubo dimidio breviore et stipulis angustioribus; habitu omnino diversum, capitulis ad basin ramorum glomeratis, refert potius *T. suffocatum*, L.

DALEA ONOBRYCHIS, *DC.* Upper valley of the Rimac 8000–10,000 feet! Scarcely distinct as a species from *D. Mutisii*, Kunth.

ASTRAGALUS PICKERINGII, *A. Gray, Bot. U. S. Expl. Exped.* p. 415, var. SERPENS, *nob.* Above Casapalta!

Rhizomate tenui, ramoso, caudiculos humifusos longe serpentes sæpius subterraneos, stipulis ultra medium coalitis vaginantibus instructos, demum sub diu foliiferos, edente; foliis confertis, cano-villosis, 10–15-jugis; foliolis oblongis, obtusis, truncatis; pedunculis axillaribus, paucifloris, petiolis vix æquilongis; calycis tubo longiusculo, quam dentes subæquales lineares obtusiusculi duplo longiore; petalis ochroleucis, vexillo calycem vix duplo superante; legumine —?

A small specimen in Kew Herbarium from Wilkes's Exploring Expedition shows something of the same mode of growth, but much less marked than in the Casapalta specimens.

ASTRAGALUS CASAPALTENSIS, n. sp. Above Casapalta, about 14,300 feet!

Pygmæus, rhizomate lignoso; ramis plurimis brevissimis prostratis, stipulis fere usque apicem coalitis obtectis, deinde foliiferis et florigeris; foliis novellis sericeis, mox glabrescentibus, 10–14-jugis; foliolis late oblongis ovalibusve, obtusis, sæpius truncatis; floribus axillaribus, solitariis vel geminis, subsessilibus; calycis pilosi tubo campanulato, dentibus oblongo-lanceolatis, obtusiusculis, æquilongis; vexillo læte purpureo calyce bis longiore; ovario piloso, 4-ovulato.

A very distinct species, with smaller flowers than any other of this group that I have seen. *A. Alpamarcæ*, A. Gray, Bot. U. S. Expl. Exped., has fewer leaflets, and differs in the structure of the calyx, which has sharp triangular teeth, and in the two-celled ovary, which has only one ovule in each cell. *A. uniflorus*, DC., which has flowers twice as large, differs more widely from the Casapalta plant.

Rosaceæ.

Acæna lappacea, *Ruiz & Pav.* Chicla!

Acæna —— ? Chicla! A plant doubtless belonging to this genus, but without flower or fruit.

Alchemilla pinnata, *Ruiz & Pav.* Chicla! Casapalta!

Saxifragaceæ.

Saxifraga cordillerarum, *Presl*, var. decipiens, *nob.* Chicla!

Tenuiter glanduloso-hirtella, foliis caudiculorum latis trifidis, lobis exterioribus sæpius bifidis, nervis lateralibus furcatis, scaporum florentium foliis integris bracteiformibus.

Saxifraga cordillerarum, *Presl*, var. nivalis, *nob.* Above Casapalta!

Pygmæa, foliis omnibus subæqualiter trifidis, lobis oblongo-linearibus, dense glanduloso-pubescentibus.

In spite of considerable differences, I have no hesitation in regarding these as varieties of the same species, which, as Engler has shown, is an eminently variable one, not widely differing from the European *S. decipiens*, Ehrh., which it represents in the southern hemisphere.

Crassulaceæ.

Tillæa connata, *Ruiz & Pav.* = *T. rufescens*, H. B. K. Common about Chicla! The flowers are tetramerous, the leaves more or less completely connate.

Cotyledon incanum, n. sp. Chicla!

Caule erecto, 6–8-pollicari, inferne ramoso; ramis lateralibus brevibus crebre foliatis, foliis ovali-cylindricis teretibus; floribus 8–12 in racemum brevem dispositis, erectis, superioribus sessilibus, inferioribus breviter pedicellatis, pedicellis basi bracteatis; sepalis ovali-lanceolatis, viridibus margine pallidis; corolla subtubulosa; petalis ochroleucis vel pallide rubentibus, lineari-lanceolatis, acutis, quam sepala sesquilongioribus, usque ad tertiam vel dimidiam partem coalitis.

A very distinct species, with the leaves and habit of a *Sedum* rather than those of the characteristic American group of *Echeveriæ*, with which, nevertheless, it must be united.

COTYLEDON CHICLENSIS, n. sp. Chicla!

Radice crassa, fusiformi, pluries furcata; foliis radicalibus dense rosulatis, glaberrimis, lineari-lanceolatis, acutis, 6–8 pollices longis, crasse succulentis; caule erecto, 12–18-pollicari, foliaceo; foliis caulinis numerosis, oblongo-lanceolatis, sessilibus, basi calcaratis; floribus omnibus pedicellatis, erectis vel demum nutantibus, pedicellis inferioribus 6–8-linearibus, superioribus sensim brevioribus, bracteis pedicello subæquilongis; calycis segmentis ovatis, obscure virentibus; petalis coccineis, lineari-oblongis, acuminatis, calycis longitudinem ter superantibus, basin versus usque ad quartam partem coalitis. Carpellis siccis (emarcidis) sensim acutatis, subrecurvis, divaricatis.

An ornamental plant, with a general resemblance to several of the cultivated species of the *Echeveria* group; but I find it impossible to identify it with any of those hitherto described.

SEDUM ANDINUM, n. sp. Chicla!

Planta pygmæa, cæspitosa, e basi ramosa; ramis numerosis, tenuibus, 2–3-pollicaribus, florigeris erectiusculis; foliis hemisphæricis minutis; cyma subquadriflora, flore terminali sessili, lateralibus breviter pedicellatis; sepalis ovato-ellipticis, dimidiam longitudinem petalorum æquantibus vel paullo superantibus; petalis oblongo-lanceolatis, obtusiusculis, atrorubentibus, ima basi coalitis. Stamina 10.

Very distinct from any Mexican or other American species hitherto described; and the first *Sedum*, so far as I know, that has been found in South America.

ONAGRARIEÆ.

ŒNOTHERA MULTICAULIS, *Ruiz & Pav.*, var. PETIOLARIS, *nob.* Chicla!

Foliis radicalibus et caulinis inferioribus in petiolum attenuatis.

ŒNOTHERA PSYCHROPHILA, n. sp. Chicla!

E basi ramosa; ramis adscendentibus glabris vel superne puberulis; foliis ovato-lanceolatis, in petiolum sensim attenuatis, margine subintegerrimis, vix aut ne vix obscure denticulatis, glabris; calycis tubo incano, sub anthesi supra medium constricto, laciniis liberis, petalis saturate roseis subæquilongis; capsula

(haud omnino matura) sessili, clavata, striata, sulcata. Affinis *Œ. prostratæ*, Cav., a qua differt foliis subintegerrimis petiolatis glabris, et calyce fructifero duplo breviori; ab *Œ. epilobiifolia* longius distat florum colore, capsula sessili, non tetraptera, cæterisque notis.

Œnothera rosea, *Ait.* Upper valley of the Rimac, 8000–10,000 feet! A form with leaves broader and more numerous than usual.

Œnothera ——? Above Casapalta, about 14,300 feet. A mere imperfect fragment of a dwarf species of this genus.

Loasaceæ.

Mentzelia hispida, *Willd.* Rimac valley, above Matucana, *R. Ward.*

Loasa xanthiifolia, *Juss.*? Chicla! A single dwarf specimen of a seedling with two small flowers; rather uncertain.

Loasa grandiflora, *Juss. Ann. Mus. Par.* v. p. 26, tab. 4; *Lam. Dict.* Chicla! All the leaves in my specimens are alternate, the flowers of a deep orange. The long hairs which clothe the entire plant are extremely stiff, easily penetrating thick gloves.

Blumenbachia carduifolia = Loasa carduifolia, *Presl.* Common about Chicla! Puente Infernillo, *R. Ward.* The slender but rather stiff stems twine, although in this district the plant ordinarily grows in positions where it can obtain no support by so doing.

Passifloraceæ.

Malesherbia thyrsiflora, *Ruiz & Pav.* Above Matucana, flowering in May, collected by Mr. R. Ward. A curious species, very unlike the Chilian plants formerly ranked under *Malesherbia*, but now united to *Gynopleura* in Benth. & Hook. f. 'Gen. Plant.'

Cucurbitaceæ.

Sicyos subcorymbosus, *Cogn. in DC. Monog. Phan.* iii. p. 887. Chicla, on rocky ground, climbing over low bushes!

Datisceæ.

Datisca glomerata, *Benth. & Hook. fil.*=Tricerastes glomerata, *Presl, A. DC. Prod.* xv. pars 1, 411. Above Matucana in the valley of the Rimac, at above 9000 feet! This may possibly have been introduced during the construction of the railway, though such an accident is no way probable. It appears to have its proper home in Mexico, whence it has spread northward to S. California.

Umbelliferæ.

Bowlesia palmata, *Ruiz & Pav.*? Chicla! Upper valley of the Rimac, about 10,000 feet! The group of species to which this and the following *Bowlesiæ* belong appears to be extremely variable; and I much doubt the constancy of the characters on which several species are founded, nor do I feel confident that those found by me in Peru are here correctly referred to the species of the authors quoted.

This is a comparatively large plant, from 12 to 18 inches in height, with numerous suberect branches; the hairs are stellate; the lower axillary umbels are shortly pedunculate, but the terminal umbel is usually on a long peduncle.

Bowlesia acutangula, *Benth. Pl. Hartw.* p. 186. Chicla! This has a feeble little branched stem, rarely erect, beset with long simple hairs, the leaves thin, with very acute angles to the lobes and incisions, the umbels on long peduncles, the fruit beset with stiff stellate hairs.

Bowlesia lobata, *Ruiz & Pav.*, var. chilensis, *nob.*? Chicla! This has suberect branches, with stellate hairs, the leaves three-lobed, with the middle and longer lobe oblong acute, and the lateral lobes entire or slightly toothed, the umbels on peduncles equalling the length of the petioles, the hairs of the fruit glochidiate.

Bowlesia lobata, *Ruiz & Pav.*, var. humifusa, *nob.*? Chicla! A small depressed plant with numerous short prostrate branches, the leaves divided into five equal lobes, the umbels subsessile, or on short peduncles. It is with much doubt that I refer this and the preceding plant to forms of *B. lobata*. The typical plant

differs from both in not having glochidiate hairs on the fruit, and from the latter, among other points, by the umbels being on moderately long peduncles. Other differences may be pointed out between my specimens and *B. incana*, Ruiz & Pav., and *B. pulchella*, Wedd.; but I am inclined to think that both of these will also be ranked as varieties of *B. lobata*.

Oreomyrrhis andicola, *Endl. Gen.* p. 787*. Chicla!

Apium leptophyllum, *F. Muell.* = Helosciadium leptophyllum, *DC.* = Ammi leptophyllum, *L.* Upper valley of the Rimac near Matucana!

Daucus torilioides, *DC.* Upper valley of the Rimac, about 10,000 feet!

Caprifoliaceæ.

Sambucus peruviana, *H. B. K.* Here and there in the upper valley of the Rimac, extending to a height of above 13,000 feet, but possibly planted at the higher stations! It forms a tree from 20 to 30 feet in height, and about a foot in diameter.

* I have here blindly followed the authority of Endlicher, sanctioned by that of the authors of the 'Genera Plantarum;' but I must remark that in this case the first has committed, and the second have sanctioned, an error in nomenclature, having apparently overlooked a note in the fourth volume of De Candolle's 'Prodromus,' p. 229, wherein the facts are clearly stated. The Andean plant, which is the representative of a group of forms peculiar to the southern hemisphere, was described by Kunth in the fifth volume of the great work of Humboldt and Bonpland, 'Nova Genera et Species,' &c., which was published, in 1821, under the name *Myrrhis andicola*. In the same year Lagasca, rightly regarding the plant as the type of a new genus, published his description of the genus *Caldasia*, and in a letter to A. P. de Candolle, published by the latter in the collection of his botanical dissertations, named the plant *Caldasia andicola*. In preparing his great work on the genera of plants, Endlicher found that, long before Lagasca, Willdenow had given the name *Caldasia* to a Mexican plant forming a distinct genus of Polemoniaceæ. Concluding that Lagasca's genus *Caldasia* could not be retained, he gave to it the new name *Oreomyrrhis*. But in so doing he overlooked the fact, pointed out by De Candolle, that Willdenow's genus *Caldasia* was identical with *Bonplandia* of Cavanilles, published seven years earlier; and that in consequence the generic name *Caldasia* had fallen to the ground when Lagasca applied it to the plant from the Andes, which should, according to the established rules of nomenclature, be termed *Caldasia andicola*, Lag. The priority of Cavanilles's generic name *Bonplandia* over Willdenow's *Caldasia* is recognized by Bentham and Hooker in Gen. Plant. ii. p. 824.

Rubiaceæ.

Mallostoma thymifolia, *Benth. et Hook. fil*=Hedyotis thymifolia, *Ruiz & Pav.* Upper valley of the Rimac above Matucana, *R. Ward.* In the single specimen collected by Mr. Ward the segments of the calyx are larger than in the specimens preserved in Kew Herbarium; but in this group, as in the European genus *Asperula*, the length of the calyx-segments, as well as that of the corolla-tube, varies much in forms of the same species.

Relbunium tuberculosum=Rubia tuberculosa, *Benth. Pl. Hartw.* p. 195,=Galium Benthamianum, *Walp. Rep.* vi. p. 17. Above Casapalta, about 14,300 feet! This cannot be separated from the genus *Relbunium.* That genus is well characterized by involucrate flowers and articulate pedicels; but no one of the species is distinguishable in appearance or habit from some species of *Galium.* The present plant might easily be taken for some Pyrenean or Alpine *Galium.*

Galium Aparine, *L.* Chicla!

Valerianeæ.

Valeriana armeriæfolia, *Schlecht. in Lechler, Pl. Peruv.* Above Casapalta! My specimens closely agree with those of Lechler, named by Schlechtendahl; but I doubt whether they are sufficiently different from *V. coarctata,* Ruiz & Pav., to deserve separate specific rank.

Valeriana remota, n. sp. Chicla!

Annua vel biennis, radice incrassata; caule sæpius solitario, simplici, erecto, glaberrimo; foliis radicalibus lanceolato-spathulatis, in petiolum longum sensim attenuatis, subintegerrimis, præter marginem et nervum dorsalem scabriusculos, glaberrimis, caulinis paucis sæpius integris, lanceolatis, in petiolum alatum contractis, interdum lobo brevi angustato utrinque adjecto; inflorescentia aphylla ex cymis binis oppositis ad quodvis internodium, inferioribus remotis, breviter pedunculatis, laxiusculis, summis approximatis densis; achenio 2 millim. longo, pappi sexradiati setis basin versus membranaceo-alatis, connatis.

A very distinct species, seemingly common about Chicla! varying in height from 6 inches to 2 feet.

Valeriana interrupta, *Ruiz & Pav.* Chicla! A plant from 2 to 3 feet in height, with much the habit of the European *V. officinalis.*

VALERIANA INTERRUPTA, *Ruiz & Pav.*, var. MINOR, *nob.* Chicla! This is very much smaller than the typical species, with stems from 5 to 6 inches in height; but I have not observed any further difference. I did not notice intermediate forms, although both appear to be rather common about Chicla.

COMPOSITÆ.

EUPATORIUM PERSICIFOLIUM, *H. B. K.* Chicla!

EUPATORIUM BALLII, *Oliv. in Herb. Hook. Ic. Pl.* ser. 3, v. tab. 1462. Chicla! A dwarf form above Casapalta, about 14,300 feet above the sea!

I quote Professor Oliver's description:—"Fruticosum, ramulis glanduloso-tomentellis, foliis lineari-ovalibus utrinque attenuatis obscure crenulatis, margine vernatione plus minus revoluto, supra rugulosis puberulo-hirtellis, subtus tomentellis areolato-reticulatis, capitulis multifloris majusculis pedunculatis in cymis pleiocephalis terminalibus dispositis, bracteis involucri pluriseriatis, exterioribus ovato-ellipticis acutis striatis parce piloso-tomentellis, interioribus oblongo- vel lineari-lanceolatis acuminatis disco paullo brevioribus, acheniis gracilibus 5-costatis glabris inferne angustatis, pappo uniseriato setaceo." A shrub 5–8 feet in height, the leaves on very short petioles, the flowering heads on peduncles that lengthen after fertilization, finally drooping; belonging to a group of which many forms are found in the Andes. It is distinguished from *E. glutinosum*, Lam., *E. salviæfolium*, H. B. K., *E. lavandulæfolium*, DC., *E. Gayanum*, Wedd., and *E. gynoxioides*, Wedd., by the much larger, less crowded, and drooping capitula; from the first and from several others by the leaves tapering to the base, and not at all cordate.

EUPATORIUM STERNBERGIANUM, *DC.* Common in the upper valley of the Rimac, growing to a height of several feet! About Chicla; a reduced form!

EUPATORIUM ——? Puente Infernillo, about 11,000 feet! Genus uncertain; too imperfect for determination.

STEVIA ——? Chicla! I am unable to identify this plant, of which I have but an imperfect specimen, with any of the described species. It is allied to, but certainly different from, *S. paniculata*, Lag. The stem is slender, woody, and much branched. The

leaves are slightly toothed towards the summit, oblong-lanceolate, the lower opposite, tapering at the base to a very short petiole, the upper alternate and sessile. The heads of flowers are in a compact dense corymb.

CONYZA SOPHIÆFOLIA, *H. B. K.* Chicla!

ERIGERON CANADENSIS, *L.*, var.=E. crassicaulis, *Sch. Bip.* Chicla! Upper valley of the Rimac! There can, I think, be no doubt that the form distinguished by Schultz must be referred as a variety to the cosmopolitan Linnean species.

BACCHARIS GENISTELLOIDES, *Pers.*, var. ALPINA. Above Casapalta! A dwarf form of a species widely diffused in South America.

BACCHARIS ALPINA, *H. B. K.*, var. SERPYLLIFOLIA, *Wedd. Chl. And.* Above Casapalta!

BACCHARIS CÆSPITOSA, *Pers.* Above Casapalta! This often much resembles the last species, but is, I believe, truly distinct.

BACCHARIS —— ? Common about Chicla, forming evergreen bushes from 3 to 6 feet in height. This plant is intermediate in appearance and structure between *Baccharis obovata*, H. B. K., and *B. Chilco*, H. B. K.; but without further observation, I do not venture to unite those species under a single name. It is remarkable that, excepting only the moist hot equatorial zone, the western side of the American continent, from California to the Straits of Magellan, should almost everywhere produce some forms of *Baccharis* belonging to this group differing very slightly in structure and appearance. Although I have endeavoured to make myself familiar with their distinctive characters, I doubt whether if I were to see growing together the bushes which I have observed in their native homes at Monterey in California, at Arica in Peru, at Valparaiso in Chili, and at Sandy Point in the Magellan Straits, I should at once be able to identify them. In this great and protean genus, so largely developed in South America, there is room for prolonged study and observation by the monographer of the future.

ACHYROCLINE SATUREIOIDES, *DC.* Var. foliis angustissimis velutinis? Chicla! This apparently agrees with an unnamed specimen in Kew Herbarium, collected in New Granada at a height of about 10,000 feet.

Gnaphalium spicatum, *Lam.*, var. = G. sphacelatum, *H. B. K.* Chicla!

Gnaphalium Mandonii, *Sch. Bip.* Chicla! Upper valley of the Rimac! This appears to be a variety of *G. oxyphyllum*, DC. Along with many other names given by Schultz Bipontinus, this appears in a list of Mandon's "Plants of Bolivia," published in the 'Bulletin of the Botanical Society of France,' vol. xii., without descriptions. Such a mode of publication is of doubtful validity, and open to grave objections.

Gnaphalium luteo-album, *L.* Upper valley of the Rimac, ascending to 10,000 feet!

Gnaphalium melanosphæroides, *Sch. Bip.* Chicla!

Gnaphalium frigidum, *Wedd. Chl. And.* i. p. 146, tab. 24 a. Above Casapalta!

Gnaphalium piptolepis, *Griseb. Symb.* p. 186 = Merope piptolepis, *Wedd. Chl. And.* i. p. 162. Near Chicla!

Ambrosia artemisiæfolia, var. peruviana. Common in the Rimac valley, ascending above Matucana!

Jægeria hirta, *Less.*, var. Chicla! Very small and immature specimens, doubtless referable to this species, which has a wide range both in area and in altitude.

Coreopsis fasciculata, *Willd.* Chicla! A form with the leaves narrower than usual.

Bidens andicola, *H. B. K.* Chicla! Some of my specimens present an unusually luxuriant form of this species, with larger flowers and stems from 2 to 3 feet in height.

Bidens humilis, *H. B. K.* Common and very variable about Chicla, ascending above it to a height of about 14,300 feet! Some specimens have very narrow leaves, and should perhaps be distinguished as a variety.

Bidens macranthus, *Griseb. Pl. Lorentz.* p. 138? Upper valley of the Rimac, about 10,000 feet! My specimens are immature, but approach most nearly to Grisebach's plant from the Andean highlands in the north of Argentaria.

Bidens pilosa, *L.* Common in the Rimac valley, and ascending to Chicla! It is somewhat remarkable that a species so common throughout tropical America is able to thrive at a height exceeding 12,000 feet above the sea.

Bidens chilensis, *DC.* Upper valley of the Rimac and at Chicla!

Bidens bipinnata, *L.* Upper valley of the Rimac and at Chicla! We can scarcely suppose the three species last enumerated to be aboriginal natives of the Peruvian Andes. The readiness with which the achenes attach themselves accounts for their wide diffusion by man and by animals.

Schkuhria isopappa, *Benth. Pl. Hartw.* p. 205. Near the Puente Infernillo, about 11,000 feet!

Tagetes multiflora, *H. B. K.* Upper valley of the Rimac, ascending to about 9000 feet!

Villanova oppositifolia, *Lag.* Chicla! A specimen in Kew Herbarium is said to have been found near Lima. This is scarcely probable, unless the plant had been casually carried down from the Andes by the torrent of the Rimac.

Liabum ovatum = Paranephelium ovatum, *A. Gr.* Probably a variety of *L.* (*Paranephelium*) *uniflorum.* Above Casapalta! The large stemless golden-yellow flowering heads are very conspicuous.

Senecio Bridgesii, *Hook. & Arn.* Common in the upper valley of the Rimac! Chicla! I cannot distinguish my specimens from the ordinary Chilian plant.

Senecio hyoseridifolius, *Wedd. Chl. And.* i. p. 108. Chicla! A very distinct species with large rayless capitula.

Senecio Pentlandianus, *DC.*, var. = S. adenophylloides, *Sch. Bip.* Chicla!

Senecio glareosus, *Sch. Bip.* Chicla!

Senecio comosus, *Sch. Bip.* Above Casapalta, about 14,300 feet!

Senecio glacialis, *Wedd. Chl. And.* i. p. 113, tab. 18 A. Above Casapalta!

SENECIO HUMILLIMUS, *Sch. Bip.* Var. involucri foliolis latioribus. Above Casapalta!

SENECIO CASAPALTENSIS, n. sp. Above Casapalta!

Pygmæus, subacaulis, rhizomate crasso verticali, fibros validos laterales emittente; foliis omnibus radicalibus rosulatis, ambitu obverse lanceolatis, profunde lyrato-pinnatifidis, lobis angulato-subrotundis, supremis confluentibus; capitulo solitario subexscapo, discoideo, majusculo, multifloro, diametro subpollicari; involucri foliolis linearibus adpressis, apice acutis.

SENECIO MODESTUS, *Wedd. Chl. And.* i. p. 105, tab. 18 B. Above Casapalta! I do not think that *S. Mandonianus*, Wedd., can be maintained as a species distinct from this.

Amid the multitude of stemless plants belonging to *Senecio* or nearly allied genera that abound in the upper region, it is very difficult at once to distinguish the different species, though on examination many of them display well-marked characters.

WERNERIA STRIGOSISSIMA, *A. Gray, Proc. Amer. Acad.* v. p. 140,=W. setosa, *Wedd. MSS.* Above Casapalta!

CENTAUREA MELITENSIS, *L.* Upper valley of the Rimac, ascending to about 9000 feet! This plant may probably have been introduced from Spain at an early period in the history of her American colonies. It is now widely diffused through most parts of the former Spanish territory where the climate is not too moist and hot to permit it.

CHUQUIRAGUA SPINOSA, *Don*, var. INERMIS. About Casapalta! Forming erect bushes about 2 feet in height. The lower limit observed by me was about 13,700 feet above the sea.

MUTISIA VICIÆFOLIA, *Cav.* Chicla!

POLYACHRUS ECHINOPSOIDES, *DC.* Chicla!

PEREZIA MULTIFLORA, *Less.* Var. involucri squamis latioribus apice vix mucronatis. Chicla!

PEREZIA CILIARIS, *Hook. et Arn.*=Clarionea ciliaris, *Don.* Upper valley of the Rimac above Matucana, *R. Ward.*

HIERACIUM CHICLENSE, n. sp. Chicla!

Perenne, rhizomate brevi, crasso, verticali; caule elato 2–3-pedali, ramoso, striato, inferne villoso, superne glabrescente; foliis

omnibus plus minusve albo-villosis, radicalibus ante anthesin emarcidis, cum caulinis inferioribus in petiolum longum sensim attenuatis, superioribus paucis sessilibus, oblongo-lanceolatis, remote repando-denticulatis, in pagina inferiore nervosis; ramis adscendentibus, oligocephalis, subcorymbiferis; pedunculis tomentellis vix glandulosis; involucri subcylindrici squamis irregulariter imbricatis, linearibus, acutis, fusco-villosis, intimis pappo æquilongis; achenio columnari, ecoronato (scil. costis non prominentibus), pappo niveo.

This is one of the group of *Hieracia*, of which several are now known from Central America and the Andes which by their pure white pappus approach to the genus *Crepis*. But in America it is clear that that character cannot be relied upon as of generic importance, as these plants are all closely related to species of true *Hieracium*. In appearance my specimens approach *H. trichodonta*, Sch. Bip. in Linnæa, xxxiii. p. 761, from which I think it impossible to separate *H. jubatum*, Fr. Vet. Ac. Forh. Stock. 1856, p. 146, and *Epicrisis* 147; the latter, according to Fries, is the same as *H. frigidum*, Wedd. Chl. And. i. p. 225, tab. 42 B. But my plant differs in many respects; *e. g.* in being clothed in white instead of reddish hairs, in the white pappus, and especially in the form and structure of the involucre, which approaches nearly that of the cymose group of the genus *Pilosella*, while *H. trichodonta* must be ranked in the subgenus *Stenotheca*.

HYPOCHÆRIS ELATA, *Griseb. Pl. Lorentz.* p. 138=Achyrophorus elatus, *Wedd.* Above Chicla in the fissures of rocks! This species bears at first sight a striking resemblance to the common *H. radicata*.

HYPOCHÆRIS SESSILIFLORA, *H. B. K.* Chicla! This in most respects nearly approaches *Achyrophorus Meyenianus*, Walp., which must, I think, be united with the older species.

HYPOCHÆRIS ——? Above Casapalta! This plant, which exactly agrees with No. 281 of Mandon's "Plants of Bolivia," is allied to *H. sessiliflora*, but can scarcely be united to that species. The flowering heads are much smaller, and have not nearly so many florets.

HYPOCHÆRIS TARAXACOIDES=Oreophila taraxacoides, *Meyen et Walp. Nov. Acta Acad. Leop.* xix., *Suppl.* i. p. 291=Achyrophorus taraxacoides, *Wedd. Chlor. And.* Above Casapalta!

Campanulaceæ.

Wahlenbergia peruviana, *A. Gray, Proc. Amer. Acad.* v. p. 152. Above Casapalta! A small inconspicuous plant.

A dwarf shrubby plant found at Chicla may possibly belong to the *Vacciniaceæ*; but as I saw neither flower nor fruit, I can merely express a conjecture.

Asclepiadeæ.

Lugonia andina, n. sp. On rocky ground about Chicla!

Frutex scandens, ramis tenuibus, volubilibus, 4–5 ped. longis; foliis oppositis, breviter petiolatis, ovato- vel oblongo-lanceolatis, basi cordatis, apice acutis vel acuminatis, superne glabris, in pagina inferiore tomentellis; pedunculis 1–2-floris, bractea solitaria fulcratis; calycis quinquepartiti segmentis ovato-lanceolatis puberulis; corolla late campanulata subrotata, sat magna, calycem ter excedente, diametro 1½–2-pollicari, extus puberula, in lobos quinque rotundatos ultra medium fissa, sordide purpureo-aurantiaca, tubo atropurpureo; folliculo abortu (an semper?) solitario, fusiformi, glaberrimo, 3–4 pollices longo.

Two specimens in Kew Herbarium belong clearly to this hitherto undescribed species, though showing some slight variations of structure. They were placed by Mr. Bentham in the same generic cover with *Lugonia lysimachioides*, Wedd., and though not named, are referred to in the 'Genera Plantarum' (vol. ii. p. 758) as constituting a second species of the genus *Lugonia*. Of these specimens, one marked "Peru, Maclean," has the leaves rather more deeply cordate, the calyx-segments longer, and the corolla (apparently) of lighter colour, verging on orange. The other specimen, a mere fragment from Nuttall's herbarium, gathered at Charcan (in Peru?) shows no other difference from the Chicla plant than being rather more downy on the surface.

Gentianaceæ.

Gentiana sedifolia, *H. B. K.*, var. casapaltensis, *nob.* Above Casapalta!

Foliis lineari-lanceolatis basi dilatatis, vaginantibus, muticis; scapo brevissimo; corollæ lobis intermediis primariis subæquilongis, acutis, denticulatis.

MISSOURI
BOTANICAL

Specimens of this Gentian, which in appearance much recalls the *G. prostrata* of the northern hemisphere, from different localities in the Andes, show so many varieties of structure, that they have received many different specific names. Mr. Weddell, who had ample opportunities for observing the living plants, united these as varieties of the form first collected by Humboldt and Bonpland. The Casapalta plant, though evidently belonging to the same aggregate species, differs so far from the forms enumerated by Weddell, that I have found it necessary to name it as a distinct variety.

GENTIANA VAGINALIS, *Griseb.* Chicla!

GENTIANA MULTICAULIS, *Gill.* var.? Upper Rimac valley, above Matucana, *R. Ward.* The single specimen is incomplete, and I do not feel quite confident as to its identity with the Chilian species.

HALENIA GENTIANOIDES, *Wedd.* Above Casapalta!

POLEMONIACEÆ.

GILIA LACINIATA, *Ruiz and Pav.* Chicla!

COLLOMIA GRACILIS, *Dougl.* Chicla! A dwarf form of the species.

HYDROPHYLLACEÆ.

PHACELIA CIRCINATA, *Jacq.* Chicla! As is well known, this species extends throughout the larger part of the American continent, from Oregon to the Straits of Magellan; throughout that wide area it is singularly constant, exhibiting no marked varieties.

BORAGINEÆ.

HELIOTROPIUM PARVIFLORUM, *L.* Upper valley of the Rimac, about 9000 feet! This species, whose proper home is in the lower zone, ascends from Lima along the valley of the Rimac to some height above Matucana.

HELIOTROPIUM PERUVIANUM, *L.* Upper valley of the Rimac, up to about 10,000 feet! This seems to be a native of the middle zone of the Andes. I did not observe it below the level of 7000 feet, and it becomes rare above that of 9000 feet, although it appeared to be common between those limits.

Cynoglossum revolutum, *Ruiz & Pav.* Chicla!

Eritrichium linifolium, *A. Gray, Proc. Amer. Acad.* x. 54 =Anchusa linifolia, *Lehm. Asperif.* No. 158 (1818)=Anchusa oppositifolia, *H. B. K. Nov. Gen. et Sp.* iii. 91, tab. 200=Antiphytum linifolium, *DC. Prod.* x. 122. Chicla! Walpers described under the name *Anchusa Kunthii* (*Antiphytum Walpersii*, A. DC. Prod. l. c.) a plant differing from Lehmann's type only in having leaves "twice or four times as long." My specimens vary very much in this respect, and I doubt whether the name *E. Walpersii* should be retained even for a variety. Lehmann founded his description on specimens contained in Willdenow's herbarium, to which the latter had given, in manuscript, the names *Anchusa linifolia* and *A. leucantha*; Roemer and Schultes declare this to have been an error on Lehmann's part, and that instead of one species with two names, there existed in Willdenow's herbarium two different species both labelled *Anchusa linifolia.*

Eritrichium Mandonii, n. sp. Chicla!

Bienne? caule e basi ramoso, ramis adscendentibus, foliaceis, 6–12 poll. longis; foliis cum ramis et calyce strigoso-pilosis, sessilibus, semiamplexicaulibus, oblongis, apice sensim acutatis; floribus subsessilibus in cymam densam congestis, uno alterove axillari remotiusculo; calycis segmentis in fructu elongatis, linearibus; corolla parva, ochroleuca; nuculis corrugato-lacunosis.

My specimens, from which the description is taken, agree with No. 378 of Mandon's 'Plants of Bolivia.' In appearance the plant recalls *Amsinckia angustifolia*, Lehm.

Convolvulaceæ.

Dichondra repens, *Forst.* Chicla!

Cuscuta chilensis, *Ker.* Upper Rimac valley, near Matucana. *R. Ward.*

Solanaceæ.

Solanum tuberosum, *L.*? Growing among dense bushes beside the torrent a few hundred feet above Chicla! I was unable to obtain the root of this plant, and I do not feel certain as to its identity. In spite of the assistance derived from Mr. Baker's careful investigation of this group of *Solanum*, I find it

very difficult to trace clear lines of demarcation between the species, even as limited by him. *Solanum Maglia* in particular appears to vary very much, and I perceive no constant diagnostic character by which to recognize it with certainty. Even if the plant found by me should be a true potato, I do not regard its occurrence as evidence of *S. tuberosum* being indigenous in Peru. The line of communication between the sea-coast and the highlands of Peru by the upper valley of the Rimac was doubtless in frequent use under the rule of the Incas, and we know that the potato was cultivated by the Peruvians long before the Spanish conquest. It would, in my opinion, require much more evidence than we now possess to make it probable that it occurs as a true native anywhere north of Chili.

Solanum angustifolium, *Ruiz & Pav.* var. = S. pulverulentum, *Pers.* Chicla!

Solanum Pentlandi, *Dun.* Chicla! Upper valley of the Rimac, 8000 to 10,000 feet. I doubt whether this should be separated from *S. chenopodioides*, Lam.

Solanum radicans, *Ruiz & Pav.* Upper Rimac valley, from 9000 to 11,000 feet above the sea! *S. ruderale*, Cl. Gay, Fl. Chil., seems to me not different from this species.

Solanum ——, n. sp.? Upper valley of the Rimac, about 9000 feet!

A *Solano rhamnoide*, Dun. in DC. Prod. xiii. 160, differt pluribus notis gravioribus:—1. planta tota glabra, nisi nervo medio et nervis lateralibus primariis (prominentibus, nec vix conspicuis), in pagina inferiori foliorum fusco-pulverulentis, cum fasciculo lanæ tomentosæ ad insertionem nervorum lateralium; 2. calycis segmentis rotundatis, obtusissimis, nec triangularibus, acutis; 3. stigmate clavato, nec obcordato. Planta insignis est ob pedicellos etiam ante anthesim recurvos, pendulos. Segmenta corollina ochroleuca, trinervia. Bacca magnit. nucis avellanæ, fusco-atra.

Amidst the vast crowd of species, many of which I have not seen, this may possibly have been described, and I think it better not to coin a new name.

Lycopersicum peruvianum, *Mill.* Ascends from the coast along the Rimac valley to a height of 8000 feet!

Hebecladus biflorus, *Miers*=Atropa biflora, *Ruiz & Pav.* Chicla!

Nicandra physaloides, *Gaertn.* Upper Rimac valley, between 8000 and 10,000 feet!

Physalis peruviana, *L.*=P. edulis, *Sm.* Upper Rimac valley, at about 10,000 feet!

Nicotiana glutinosa, *L.*, var. foliis basi non cordatis, corolla breviore. About Chicla frequent!

Scrophularineæ.

Calceolaria virgata, *Ruiz & Pav.* Chicla!

Calceolaria lobata, *Cav.* Chicla!

Calceolaria tenuis, *Benth.* Chicla!

Calceolaria ovata, *Sm.*=C. biflora, *Ruiz & Pav.*, non *Lam.* Chicla!

Calceolaria bartsiæfolia, *Wedd.* Chicla!

Alonsoa acutifolia, *Ruiz & Pav.* Chicla! A very ornamental plant, growing from 2 to 4 feet in height.

Mimulus glabratus, *H. B. K.* In moist places above Chicla!

Ourisia ——? Upper valley of the Rimac, near Matucana! A single and imperfect specimen, evidently allied to *O. chamædrifolia*, Benth., but apparently different from that species.

Castilleja fissifolia, *L.*, fil. var. pumila=C. pumila, *Wedd.* Above Casapalta! In his 'Chloris Andina,' vol. ii. pp. 118, 119, Weddell has united under *C. fissifolia* no less than eight species described by various authors, including his own *C. pumila*, under which name he had previously described a plant closely agreeing with my Casapalta specimens. The opinions of such a competent botanist, who enjoyed such ample opportunities for observation, are deserving of all respect. It would appear from his remarks that, in the group of forms here united, the length of the style and that of the stamens are as subject to variation as are the length of the calyx and corolla, and the form of the leaves.

Bartsia patens, *Benth.* Above Casapalta!

Bartsia gracilis, *Benth.* Chicla!

BIGNONIACEÆ.

TECOMA SAMBUCIFOLIA, *H. B. K.* Upper valley of the Rimac, near Matucana, R. Ward. Collected in May.

VERBENACEÆ.

VERBENA LITORALIS, *H. B. K.* Upper valley of the Rimac! Chicla! This species, so widely spread in South America, ranging from the coast to a considerable height in the Andes, and extending from the Northern United States to Chili and Patagonia, is very nearly allied to *V. officinalis,* and it is often difficult to distinguish them.

VERBENA HISPIDA, *H. B. K.* Upper valley of the Rimac, ascending to 10,000 feet!

VERBENA DIFFUSA, *Wedd.* Chicla!

LABIATÆ.

SALVIA RHOMBIFOLIA, *Ruiz & Pav.* Upper valley of the Rimac! Chicla!

SALVIA STRICTIFLORA, *Hook.* Rimac valley, above Matucana, *R. Ward.*

SALVIA CRUIKSHANKSII, *Benth.* Rimac valley, above Matucana, *R. Ward.*

PLANTAGINEÆ.

PLANTAGO HARTWEGII, *Decne.* Chicla! This is nearly allied to the cosmopolitan *P. major,* L.

PLANTAGO SERICEA, *Ruiz & Pav.*, var.=P. leucophylla, *Decne.* Chicla!

NYCTAGINEÆ.

COLIGNONIA BIUMBELLATA, n. sp. Upper valley of the Rimac, near Tamboraque, about 9000 feet above the sea!

Caule erecto, glaberrimo, nodoso; foliis oppositis lævissimis, late deltoideo-ovatis vel rhombeo-orbicularibus, basi truncatis, vix aut ne vix cordatis; petiolis tenuibus limbi dimidiam vel tertiam partem longitudine æquantibus; ramis herbaceis, umbellatis, iterum in umbellam florigeram superne divisis; umbellæ radiis (vel pedunculis) umbellulam 10–20-floram gerentibus; staminibus perigonium subduplo superantibus; petalis pro genere majusculis; fructu nimis immaturo.

Very distinct from the two described species, *C. parviflora,* Chois., and *C. scandens,* Benth.

Amarantaceæ.

Amarantus chlorostachys, *Willd.* Frequent in the valley of the Rimac, extending up to the level of about 9000 feet!

The *Amarantaceæ*, which abound in the lower region of tropical and extratropical South America, do not seem to ascend to high levels. The present species, which is almost universally diffused throughout the continent, is the only representative of the order seen by me in the middle region of Peru. A few miles below Matucana five or six species of this order were seen on the side of the railway line.

Chenopodiaceæ.

Chenopodium ambrosioides, *L.* Upper valley of Rimac! This ascends to about the same level as the last species!

Ullucus tuberosus, *Moq.* On rocky ground about Chicla!

Phytolaccaceæ.

Phytolacca octandra, *L.* Upper Rimac valley, near Matucana!

Polygonaceæ.

Muehlenbeckia rupestris, *Wedd.*, var. vulcanica, *nob.*=M. vulcanica, *Meisn.* in *D. C. Prod.* Very common about Chicla! I have no doubt that the two forms described as *M. rupestris* and *M. vulcanica* should be referred to the same species. The former is distinguished by larger size, more rigid woody branches, larger leaves, more persistent ochreæ, and shorter pedicels to the flowers; but I found all these marks to be eminently variable in the plant which abounds at Chicla, and which well agrees with authentic specimens of *M. vulcanica*. I doubt whether this can be well distinguished even as a variety.

The synonymy of these plants has become a little complex, but *M. rupestris* was the first correctly referred to the genus *Muehlenbeckia*.

M. rupestris, *Wedd.* in *Ann. Sc. Nat.* ser. 3, xiii. 256 (1849)= Polygonum fruticulosum, *Walp. Nov. Act. Acad. Leop.* xix. suppl. 1, 407.

M. vulcanica, *Meisn.* in *DC. Prod.* xiv. 148 (1856)=Polygonum volcanicum, *Benth. Pl. Hartw.* 81=Muehlenbeckia volcanica, *Endl. Gen.* suppl. 4, pars 2, p. 51.

Santalaceæ.

Quinchimalium ericoides, *A. Brogn. Voy. Coq.* tab. 51. About Chicla! Above Casapalta! This species has been united by Alph. de Candolle (Prod. xiv. 625) with *Q. gracile*, A. Brogn. l. c. They appear to me to be quite as distinct as any of the species of this genus.

Urticaceæ.

Urtica flabellata, *H. B. K.* Above Casapalta! To a European botanist it is somewhat surprising to find a species of this genus attaining nearly to the extreme limit of phænogamous vegetation.

Parietaria debilis, *Forst.* Chicla!

Gnetaceæ.

Ephedia americana, *H. B. K.*, var.=E. rupestris, *Benth. Pl. Hartw.* 253. Chicla! In the passage cited, Mr. Bentham pointed out the affinity of this plant with *E. americana.* With more ample materials I think he would not have hesitated to unite them under one specific name.

Irideæ.

Sisyrinchium junceum, *E. Meyer.* Chicla! Casapalta!

Sisyrinchium junceum, *E. Meyer*, var.=S. scirpiforme, *Poepp. Fragm.* Syn. 2. Chicla! This should perhaps be regarded rather as a luxuriant state of the typical species than as a true variety.

Amaryllideæ.

Alstrœmeria peregrina, *L.*? Chicla! The solitary specimen is very imperfect, and I do not feel confident as to its identity with the Linnean species.

Liliaceæ.

Anthericum eccremorhizon, *Ruiz & Pav.* Puente Infernillo! A fragment from near Matucana collected by Mr. Ward.

Commelinaceæ.

Commelina fasciculata, *Ruiz & Pav.*, var.=C. nervosa, *R. P.* Puente Infernillo! Upper valley of the Rimac, near Matucana, *R. Ward.*

JUNCACEÆ.

LUZULA RACEMOSA, *Desv.* Chicla!

LUZULA RACEMOSA, *Desv.*, var. HUMILIS = L. humilis, *Buchen.* in *Abhandl. Nat. Ver. zu Bremen*, 1874, 125. Above Casapalta, about 14,300 feet! This plant, which bears a striking resemblance to our European *L. spicata*, appears to differ only in its smaller size and more contracted inflorescence from *L. racemosa*, as the learned author of the species, to whom we are so much indebted for our knowledge of the South American *Juncaceæ*, appears finally to hold. See 'Kritische Zusammenstellung der bis jetzt bekannten Juncaceen aus Süd-Amerika,' by Franz Buchenau, in the 6th volume of the Proceedings of the Bremen Natural History Society.

LUZULA CHILENSIS, *Nees et Meyen*, var.? Chicla! I found but a single specimen of this curious plant, which does not closely agree with any of the described species, although I have been able to compare it with authentic specimens of nearly all of them. The stem is about a foot in height, with several broad flat leaves, villous, especially at the opening of the sheath, and passing gradually into the bracts at the base of each spike. Of the latter there are three, few-flowered, lax and interrupted. So far, as well as in the hexandrous flowers, this agrees well with *L. chilensis* of Nees and Meyen; but the segments of the perigone are much longer and sharper, and dark brown in colour. The scarious bracts are very conspicuous, broadly ovate, and tapering to a long point, twice the length of the flowers, and covered, or at least bordered, with white villose hairs. In examining the South American specimens of this genus in Kew Herbarium, I have been struck by the great degree of variation in nearly all the organs, and I suspect that it may hereafter be necessary to reduce the number of species. Although they are very unlike in appearance, there is little difference in structure between *L. chilensis* and *L. alopecurus*, Desv.

GRAMINEÆ.

PASPALUM STOLONIFERUM, *Bosc*, in *Trans. Linn. Soc.* ii. 83 (1792) = P. racemosum, *Jacq. Collect. Suppl.* 32 (1796). Upper valley of the Rimac, at about 9000 feet! This grass is abundant

about Lima, where it is much valued for fodder, and has doubtless been carried by accident to the upper part of the valley.

ORYZOPSIS CÆSPITOSA, var. PERUVIANA, *nob.*=Nassella cæspitosa, *Griseb. Pl. Lorentz.* 210, var. Common at Chicla and in the upper valley of the Rimac! This differs from the type in its larger size, more lax inflorescence, and very short two-eared ligule. It is in several respects intermediate between the Chilian species of *Nassella* and the European *Piptathera*, which have all been united under *Oryzopsis* by Bentham and Hooker. Grisebach describes the awn as twice or thrice the length of the floret; in his specimens, as in mine, I found it about four times as long.

MUEHLENBERGIA ——? Upper valley of the Rimac, about 9000 feet! My specimens, which are only imperfect fragments, are allied to *M. adspersa*, Trin., and *M. clomena*, Beauv., but differ from both in the extreme shortness of the minute outer glume.

AGROSTIS NANA, *Kunth.* Above Casapalta, about 14,300 feet!

POLYPOGON INTERRUPTUS, *H. B. K.* Upper valley of the Rimac, about 9000 feet! My specimens exhibit an unusually large form of this species, which has a wide range in South America both in area and elevation.

CHÆTOTROPIS ANDINA, n. sp. Chicla!

Cæspitosa, multiculmis; culmis subpedalibus, erectis, foliorum vaginis lævibus striatis vestitis; foliorum lamina anguste lineari, plana, præter marginem asperulum glaberrima, panicula breviore; ligula bifida, oblonga, breviuscula; panicula contracta, densa, sublobata; flosculis parvis; glumis exterioribus sterilibus, subæqualibus, lanceolato-acuminatis, in carina scabriusculis, cæterum glaberrimis, scariosis, sæpius purpurascentibus; gluma fertili exterioribus paullo breviore, sub lente pubescente, flosculum involvente, infra medium arista dorsali ipsam glumam bis superante instructa, extus ad basin pilis brevibus obliquis munita; rhachilla ultra florem in setam brevissimam pilosam producta.

It has been extremely difficult to fix the true affinities of the plant here described, but in all essential respects it agrees with *Chætotropis*, of which the only known species appears to be rare in Chili, but common in the island of Juan Fernandez. This has

been separated from *Agrostis*, to which it is in other respects nearly allied, by having ordinarily, though not always, the rhachilla prolonged to a short point beyond the base of the solitary floret, and by the dense crowded panicle of minute florets. In both respects the Chicla plant agrees, except that the prolongation of the rhachilla appears to be of constant occurrence; but owing to the presence of comparatively long dorsal awns (which give the plant the appearance of a *Polypogon*), and the longer relative size of the fertile glume (which is hairy at the base), they are specifically widely different. The Chicla plant may, in technical characters, be thought akin to *Deyeuxia*, from which it chiefly differs in having the short hairs at the base of the fertile glume set on obliquely on the outer half, instead of in a complete ring, in the awn being straight instead of twisted, and in the extreme shortness of the prolongation of the rhachilla. But in my opinion its true affinity is with the group of Andine *Agrostis*, of which I have been able to examine *A. virescens*, H. B. K., and *A. foliata*, Hook, fil. These have the panicle nearly as dense as in our plant, and nearly straight awns. *A. foliata*, which is the nearest in appearance, differs in having the outer glumes nearly blunt, not acuminate, and much longer than the fertile glume. I have noticed in that species some slight and very short hairs at the base of the fertile glume, but no trace of a prolongation of the rhachilla. I venture to think that the true conclusion from the facts is that the genus *Chætotropis* should be merged in *Agrostis*.

Deyeuxia coarctata, *H. B. K.* Chicla! Either the species named or a near ally.

Deyeuxia Mandoniana, *Wedd. in Bull. Soc. Bot. Fr.* xxii. 179, var. Above Casapalta, about 14,300 feet, growing by a rivulet, with culms two feet in height! This differs from Mandon's type specimens in having the culms quite smooth throughout, and wanting the slight hairiness at the opening of the limb of the leaf described by Weddell. The leaves of the sterile shoots are numerous, erect, rigid, tightly rolled into rough wiry cylinders; the culms have few (two or three) leaves, the sheaths inflated, the ligule long and acuminate.

Deyeuxia ——, sp. nov.? Above Casapalta!

Pumila, vix cæspitosa; culmis spithamæis, lævibus; foliis glabris, radicalibus brevibus, anguste linearibus, planiusculis, vaginis

striatis parum inflatis, limbo brevissimo, canalicutato, margine involuto; ligula bifida, lata, oblique truncata, culmum amplectente; panicula contracta, bipollicari; pedicellis pilosiusculis; glumis sterilibus subæquilongis, scariosis, in carina scabriusculis, gluma fertili sterilibus dimidio breviore, cartacea, flosculum arcte involvente, pilis basilaribus subduplo longiore, medium versus arista dorsali torta ipsa gluma duplo longiore munita; palea hyalina, binervi; rhachilla ultra florem in setam penicillatam glumæ fertili æquilongam producta.

B. Weddell in Bull. Soc. Bot. Fr. xxii. p. 176 (sphalmate typographi, 156) species Andinas generis *Deyeuxiæ* 60 enumeravit, et clavem analyticam adjunxit. Descriptiones fusiores specierum novarum 37 a Weddelio propositas cel. auctor, morte prematura abreptus, nunquam publici juris fecit, et plurimarum specimina in herbariis Anglicis desunt. Etsi planta nostra Casapaltensis speciei nulli descriptæ convenire videtur, nolui nomen novum proponere. Caracteres e ligula desumptas, in hoc genere ad species definiendas utilissimas, in clavi analytica supra citata auctor prætermisit.

Deschampsia Mathewsii, n. sp. Above Casapalta!

Cæspitosa, glabra; culmis numerosis, erectis, 3–6-pollicaribus, superne nudis, basin versus foliorum vaginis striatis subinflatis vestitis; foliis rigidis, anguste linearibus, subcanaliculatis, muticis, callo cartilagineo apiculatis; ligula brevi oblongo-ovali; paniculæ parvæ ramis paucifloris; spiculis bifloris; glumis sterilibus subæqualibus, ovato-lanceolatis, acutis, in carina scabriusculis; gluma fertili hyalina flosculum involvente; palea oblonga, apice lacera; rhachilla glabra ultra flores brevissime producta.

The same species, with the outer glumes slightly shorter and less acute, was long ago collected by Mathews in the Peruvian Andes. His specimens in Kew Herbarium are numbered 689.

I collected above Casapalta a single specimen of a *Deschampsia* differing from the species above described in several respects; but all the flowers examined were abortive, and I believe it to represent merely a diseased condition of the same species.

Melica ——? Chicla! A single incomplete specimen drawn with some difficulty from amidst a group of thorny bushes. The flowers much resemble those of *M. laxiflora*, Cav.; but the leaves

are short and glabrous, and the sheaths do not approach the summit of the culm as they do in that species, which has much longer leaves, always more or less scabrous.

Dissanthelium supinum, *Trin.* Chicla! A minute species with culms two inches in height.

Eragrostis tephrosanthos, *Spreng.* (sub Poa)? Upper valley of the Rimac! A doubtful species.

The species of the genus *Poa* have been so much confused, and the descriptions of many species of which I have not seen authentic specimens are so imperfect, that, with the exception of the first, I think it best to designate by numbers the forms which I collected in the Peruvian Andes, trusting to be able at some future time to submit them to the examination of the accomplished agrostologist Professor Hackel, who has undertaken the great task of revising the entire natural order.

Poa annua, *L.* Chicla! It is an illustration of the remarkable power of adaptation to different external conditions possessed by several grasses, that in the course of the same tour I found this cosmopolitan species flowering in the Andes, in the Straits of Magellan (in winter), and within the tropics in Brazil.

Poa No. 1. Chicla! A tall grass with culms 3 to 6 feet in height; the leaves of the flowering culm striated, nearly smooth on the surface, but somewhat scabrous at the edge, those of the barren shoots convolute, the ligule short and rounded at the top; the panicle is large, widely spreading, the lower branches verticillate, the uppermost solitary, slightly rough.

Poa No. 2. Chicla! Culms little more than a foot in height; the leaves all nearly flat, more scabrous than the last; the panicle contracted, with short smooth branches of nearly equal length.

Poa No. 3. Chicla! Somewhat larger than the last, with the branches of the panicle scabrous. Probably a variety of the same species.

Poa No. 4. Chicla! This approaches our No. 1 in the form of the panicle, but on a much smaller scale, and with the branches decidedly scabrous. The ligule is oblong and truncate at the top.

Poa No. 5. Above Casapalta! A small cæspitose species, with roots of numerous strong fibres; the culms 6–8 inches in height; the leaves filiform, convolute; the branches of the small panicle scabrous.

Festuca myurus, *Ehrh.*=F. muralis, *Kunth.* At Chicla and in the upper valley of the Rimac, between 9000 and 10,000 feet above the sea! A doubtful native of South America, though now widely spread.

Festuca subuliformis, *Benth. Pl. Hartw.* 262. Above Casapalta!

Festuca casapaltensis, n. sp. Above Casapalta!

Humilis, cæspitosa, culmis adscendentibus spithamæis, angularibus; foliorum vaginis brevibus, subinflatis, limbo anguste lineari, flexuoso, canaliculato; paniculæ laxiusculæ ramis acute 3–4-angularibus, sub lente scabriusculis, apice incrassatis; glumis inferioribus longe acuminatis, extima uninervi, interiore trinervi, spiculis 3–4-floris, flosculo supremo sterili; gluma fertili tenuiter pubescente, quinquenervi, in aristam terminalem scabram ipsa gluma duplo longiorem desinente; palea bicarinata; ovario glabro; stylo subnullo; stigmatibus plumosis.

This is a very singular grass, agreeing in all essential points of structure with *Festuca*, but not at all resembling any species of that genus which I have seen. In appearance it comes nearer to some of the Mediterranean species of *Bromus*, but the nervation of the glumes makes it unfitting that genus. Among *Festucæ* its least distant alliance seems to be with the Mexican *F. livida*, Willd. (*Helleria* of Fournier), and its very near neighbour *F. cacuminis*, Hemsl. MSS.

Festuca —— ? F. Molli, *Kunth*, proxime affinis. Chicla! I drew from amidst dense bushes a single imperfect specimen of a grass 4 or 5 feet high with a large lax few-flowered panicle, which appears to be nearly allied to Kunth's *Festuca mollis*, and may perhaps represent an extreme state of that species. It is certainly a *Festuca*, with four or five florets in each spikelet, and short oval awnless glumes, recalling the appearance of some species of *Bromus* of the *Serrafalcus* group.

Bromus Hænkeanus, *Presl.* Chicla, and in the upper valley of the Rimac! I feel uncertain whether this should be kept distinct from *B. unioloides*, H. B. K., which has a very wide range in South America.

Bromus lenis, *Presl?* Found in the upper valley of the Rimac and at Chicla, the specimens varying much in size and appearance! I have not seen authentic specimens of Presl's plant, but mine agree fairly well with his description. By a printer's blunder the species appears as *B. tenuis*, Presl, in Steudel's Synopsis. No. 1370 of Mandon's 'Plants of Bolivia' agrees closely with my specimens from Peru. It has been placed in Kew Herbarium in the same cover with *B. auleticus*, Trin., but cannot, I think, be united to that species.

Bromus frigidus, n. sp. Above Casapalta!

Culmis subsolitariis, tenuibus, 9–15-pollicaribus, erectis, lævibus; foliorum vaginis striatulis, dimidiam culmi altitudinem vix attingentibus, limbo brevi, plano, præsertim margine piloso; ligula lacera; paniculæ depauperatæ secundæ ramis pubescentibus, spiculam nutantem 3–6-floram gerentibus; glumis vacuis inæqualibus, superiori quam inferior sesquilongiori; gluma fertili ovato-lanceolata, acuminata, tenuiter quiquenervia, puberula, apice bidentata, sub apice aristata, arista dimidiam glumæ longitudinem attingente; palea bicarinata, carinis ciliatis.

This is allied to an undescribed Andean *Bromus*—No. 1368 of Mandon's 'Plants of Bolivia'—but cannot, I think, be united with it. In Mandon's specimens the flowering glume is elliptical, almost truncate at the summit, the teeth scarcely perceptible, and the awn decidedly shorter. The nerves of the flowering glume are salient in his plant, while in ours they are very feeble.

Filices.

Woodsia obtusa, *Torr.*, var. = Cheilanthes crenata, *Kunze.* Chicla!

Cystopteris fragilis, *Bernh.* Chicla!

Adiantum æthiopicum, *L.*, var. = A. chilense, *Kaulf.* Chicla!

Cheilanthes Mathewsii, *Kunze.* Chicla!

PELLÆA PULCHELLA, *Fée*. Upper valley of Rimac near Matucana, *R. Ward*.

ASPLENIUM GILLIESIANUM, *Hook*. Abundant about Chicla! Most of the specimens of this fern have come from the Chilian Andes, and except mine I have seen none from Peru. Some of my specimens exactly agree with those first collected by Gillies, but others are intermediate between Hooker's species and *A. fragile* of Presl. These represent the northern *A. viride* in South America, and it is allowable to doubt whether either should be regarded as a distinct species.

ASPLENIUM TRIPHYLLUM, *Presl*. About Chicla, very sparingly! Upper valley of the Rimac, a single frond. *R. Ward*.

POLYPODIUM ATACAMENSE, *Baker, MSS*. Chicla! My specimens closely agree with one from the higher part of the Atacama desert sent to Kew Herbarium by Dr. Philippi, labelled by him *Polypodium squamatum*, but certainly not the species so named by Linnæus. Mr. Baker has affixed the manuscript name *P. atacamense*, and will doubtless describe the species in the next edition of the 'Species Filicum.'

NOTOCHLÆNA SQUAMOSA, *Fée*. Upper valley of the Rimac, above Matucana. *R. Ward*.

I cannot close this enumeration without expressing my obligations to Prof. Oliver and to Mr. Baker for the friendly assistance which they have repeatedly afforded to me in determining my Andean specimens, as well as those collected in other parts of South America.

Contributions to South-African Botany.—ORCHIDEÆ. Part II. By HARRY BOLUS, F.L.S. With Additional Notes by N. E. BROWN, A.L.S.

[Read November 19, 1885.]

(PLATE I.)

CALANTHE NATALENSIS, *Reichb. f.* (*Bonplandia*, 1856, p. 322). Folia 5–6, oblongo-lanceolata, nervoso-plicata, basi angustata, glabra vel minute pubescentia, 25–35 cm. longa, 6–8 cm. lata; scapus strictus, teres, pubescens, vaginis 2–3 distantibus præditus, 35–45 cm. longus; spica laxe 15–18-flora, bracteis ovario parum brevioribus persistentibus; flores expansi 3 cm. lati; sepala lanceolata acuta, 1·5 cm. longa, extus pubescentia; petala lateralia oblanceolata, æquilonga, glabra; labellum trilobatum, porrectum, subæquilongum, lobo medio antice subtruncato, emarginato, sub apice mucronato, lobis lateralibus cuneatis multo brevioribus subobtusis, disco seriebus tribus callorum instructo, basi in calcar filiforme arcuatum plerumque ovario longius productum; ovarium gracile, arcuatum, pubescens, 2·5 cm. longum.—*Bot. Mag.* t. 6844. —C. sylvatica, var. natalensis, *Reichb. f. in Linnæa*, xix. p. 374. (Ex exempll. viv. duobus cultis sub num. 6101 exsiccatis.)

Hab. In sylvis primævis Perie Bush dictis, ditione King William's Town, Kaffrariæ Britannicæ, flor. Dec.–Jan., legit *A. Walsh*; tum in hortis botanicis Port Elizabeth et Cape Town culta.—*Bolus* 6101. "Thickest and rockiest part of Perie Bush," *D'Urban* No. 108. "Kirkman's cutting, Maritzburg Road, 1500–2000 ft.," Natal, *Sanderson* 1047; "Bush Swamp, The Bluff, head of Natal Bay," *Sanderson* 1003; Natal, *Buchanan*. In herb. Kewensi, &c.

The flowers are lilac, the labellum showing a tendency towards a salmon-colour as they advance in age. The species is nearly allied to *C. Masuca*, Lindl., Bot. Mag. t. 4541. The habitat is interesting as being the first time that any species of this genus has been recorded from the Cape Colony proper.

[The labellum of this species appears to vary considerably in the size of the lateral lobes; in the typical form as described by Reichenbach, they are very small, and the middle part of the labellum between them and the front lobe narrow; in Mr. Bolus's plant they are much larger and about equal the front lobe in

expanse, and the middle part is broader than in the type; other specimens in the Kew Herbarium are intermediate, and one specimen (Natal, *Buchanan*) has both forms of lip on the same spike.—*N. E. B.*]

SATYRIUM OCHROLEUCUM, *Bolus*, n. sp. Glabrum, erectum, subdebile, spithamæum vel pedale. Folia duo, humifusa, elliptica subobtusa vel acuta, multinervia, basi vaginantia, 8–10 cm. longa, 5–9 cm. lata, superiora 3 sensim in vaginas ampliatas foliaceas apice patentes abeuntia; spica laxe multiflora, 8–20 cm. longa, 2·5 cm. lata, bracteis lanceolatis reflexis ovarium plus minus excedentibus; sepala lateralia oblonga, subfalcata, obtusa, 6 mm. longa; sepalum alterum et petala lateralia linearia obtusa, 5 mm. longa; labellum galeatum, 7–8 mm. longum, ore anguste elliptico margine angustissime recurvo, apice producto, erecto vel subreflexo, obtuso, minute erosulo, calcaribus filiformibus patento-divaricatis 1–1·3 cm. longis, ovarium parum superantibus; rostellum oblongum antice angustatum; columnæ lobus stigmatiferus semiorbiculatus; ovarium costis acutis, circa 1 cm. longum. (Ex exempll. plur. viv. in Herb. Norm. Austr.-Afr. sub num. 318 distrib.)

Var. β. *major*. Scapus rectior robustior, flores majores ochrorubescentes; labellum galeatum ore late elliptico vel hippocrepiforme.—Orchis bicornis, *Jacq. Hort. Schœnbr.* ii. p. 26, t. 179 (*non Linn.*).

Hab. In clivis orientalibus montis Diaboli prope Cape Town, alt. 1500 ped., flor. Oct., legit *A. Bodkin* (*Bolus* 4982 !); Tulbagh Kloof, Oct., Herb. Norm. Austr. Afr. 318 ! Hex River, *Tyson* 645 !—Var. β cum forma typica Tulbagh Kloof, *Bolus* 5371 !; *Drège* 1257*a* !

The colour of the flowers is a pale ochre-yellow, and the whole plant has the scent of *Anthoxanthum odoratum*. The species is intermediate between *S. candidum*, Lindl. (with which, as Mr. N. E. Brown informs me, Lindley himself confused it) and *S. foliosum*, Sw. (not the plant Lindley described as *S. foliosum*). The habit of this species is weaker, the spike laxer, the flowers more spreading, and their size smaller than in *S. candidum*, besides some differences in the shape of the perianth. The var. β is more like *S. candidum* in the dried state, but is less robust. The colour of the flowers in *S. candidum* is always white or a very pale rose. From *S. foliosum*, which our plant more resembles in habit, it may be readily known by its much shorter spurs, and the larger lower leaves.

SATYRIUM EMARCIDUM, *Bolus*, n. sp. Glabrum, erectum, 10–18 cm. altum; folium radicale ovatum vel subrotundum acutum, basi caulem amplectens, 5–6 cm. latum et longum, caulina 3–4 ovata sensim minora, superiora in vaginas reducta; spica 6–12-flora, 2–5 cm. longa; sepala lateralia subcymbiformia, medio constricta quasi incisa, acuta; sepalum alterum ligulatum acutum; petala lateralia ovata acuminata; labellum galeatum, ovatum, apice cristato, acuminatum, calcaribus filiformibus ovario æquilongis, totis erectis alte connatisque, apicibus cito marcescentibus, sepalo intermedio deflexo excepto; galea 8 mm. longa, calcaribus 6 mm. longis, ceteris 6 mm. longis; columna deflexa; rostellum apice umbonatum, stigmati emarginato æquilongum; antheræ connectivum in acumen liberum subulatum productum; ovarium ellipticum costatum 6 mm. longum. (Ex exempll. plur. viv. sub num. 4847 distrib.)

Hab. In solo arenoso Fish Hoek juxta oras sinus False Bay Peninsulæ Capensis, fl. Sept., *Bolus* 4847; Herb. Norm. Afr.-Austr. No. 159.

The flowers are a yellowish or dirty white, the tips of the perianth-segments very soon twisting and withering. In floral structure it comes next to *S. ligulatum*, Lindl., and by those who judge of it in a dried state only might be taken for a variety of that species. But it seems to me to differ sufficiently by its broader and shorter leaves, shorter spike, its differently shaped side-sepals and labellum, shorter stigmatic lobe, &c. The labellum in *S. ligulatum* is lanceolate and has a very unusual sigmoid flexure; here it is strictly ligulate and simply deflexed. It is to be noted, too, that while the typical form of *S. ligulatum* grows with us (on the Cape Peninsula) only on the mountains at about 2500 feet, and does not flower until December, the present species is found on the sea-level, and near the coast, and flowers in September.

SATYRIUM DEBILE, *Bolus*, n. sp. Glabrum, debile, decumbens, 15–20 cm. altum; caulis gracilis, laxe foliosus, basi vaginis 2–3 membranaceis vestitus; folia 4–5, elliptica vel lanceolata, adscendentia, acuta, subundulata, basi vaginantia, infimum 5–6 cm. longum, 2 cm. latum, superiora sensim minora; spica sublaxa angusta, 3–5·5 cm. longa, bracteæ lanceolatæ patento-erectæ, inferiores floribus longiores, superiores breviores; flores cum ovario 5–7 mm. longi; sepala lateralia elliptica; sepalum alterum

oblongum; petala lateralia subrhomboidea, omnia obtusa basi connata, patentia, vix 2 mm. longa; labellum galeatum obtusum (apice non depresso nec deflexo), ore latiore quam altiore, 2–2·5 mm. longum, basi saccis brevissimis obtusissimis auctum; columna brevis fere sessilis, lobus posticus brevis, apice emarginatus, bicallosus, stigma parvum convexum semiorbiculatum; rostellum triangulare brevissimum; antheræ loculi dissiti; ovarium late oblongum margine utrinque bicostatum, costa antica et postica fere obsoleta. (Ex exempll. plur. viv. sed floribus plerisque nimis emarcidis, sub num. 5907! distrib.)

Hab. In udis, Kleinpoort montis Winterhoek Tulbaghensis, alt. circa 3000 ped., Decembri, anno 1884, legit *A. Bodkin.*

Flowers greenish with dull red markings. Very distinct from any other species known to me by its slender weak habit, thin spike, very short sacs of the labellum, and nearly sessile column. In floral structure it is very similar to *S. Lindleyanum*, mihi.

DISA TENUICORNIS, *Bolus*, n. sp. Erecta, glabra, 10–30 cm. alta; caulis foliosus vaginis imbricantibus obtectus; folia laxa linearia acuminata, basi laxe vaginantia, adscendentia, inferiora 6–9 cm. longa, interdum medio attenuata, superiora sensim minora, basin spicæ vix attingentia; spica subdensa longitudine e tertia parte usque ad dimidium altitudinis plantæ; bracteæ ovatæ, longe cuspidatæ, membranaceæ, reticulato-venosæ, floribus subæquilongæ; sepalum alterum posticum incumbens, galeatum, late obovatum, obtusum, apiculatum, 1·5 cm. longum, 1 cm. latum, basi bisacculatum, calcare recto subfiliformi inter sacculos porrecto, 4–5 mm. longo; sepala lateralia falcato-ovata acuta, basi obliqua deflexa, 1 cm. longa; petala lateralia minuta, oblonga, lobo falcato apice aucta, horizontalia, columnæ adnata; labellum subulatum, supra basin dilatatum, acutum, 1 cm. longum; rostellum erectum, breve, integrum, glandulis polliniorum approximatis, utrinque tuberculatum; anthera horizontalis; stigma excavatum; ovarium cylindricum, 1·2 cm. longum. (Ex exempll. plur. viv. sub num. 4967 distrib.)

Hab. In rimis turfosis inter saxa in planitie inferiori montis Tabularis juxta rivulum "Hout's Bay Stream" dictum, alt. 2500 ped., flor. Oct., legit *H. Bolus.* No. 4967! in Herb. Kew; *MacOwan* 2590!

The colour of the flowers is mainly white, the galea spotted with blood-red, and the sepals, labellum, and petals edged with

the same colour, with which also the ovaries, bracts, and rhachis of the spike are more or less tinged; leaves dark green.—This is a very distinct species. In general habit it resembles luxuriant specimens of *D. tabularis*, Sond., but is readily distinguished from that by its twice larger flowers and the very peculiar thin, nearly straight, intrusely set spur, which is different from that of any other species known to me. I suppose it to be a somewhat rarely flowering species, for though I have collected on that part of Table Mountain and at that season for several years past, I never saw it until Oct. 1884; and it is not to be found amongst Ecklon and Zeyher's and Dr. Pappe's Collections in the Cape Government Herbarium.

DISA ÆMULA, *Bolus*, n. sp. Erecta, valida, glabra, 1½–2 pedalis; scapus dense foliosus; folia lanceolata acuminata, basi vaginantia, margine sæpius undulata, erecto-patentia, inferiora 15–20 cm. longa, superiora sensim minora in bracteas abeuntia; spica multiflora, 22–30 cm. longa, 2·5–3·5 cm. lata, bracteis lanceolatis acuminatissimis flores paulo superantibus; sepala lateralia oblongo-falcata, acuta, 1·4 cm. longa, 6 mm. lata; galea horizontalis, acuta, apice emarginulata, 1·7 cm. longa, calcare filiformi patente apice deflexo, 1·6 cm. longo; petala lateralia sub galea recondita, falcata, obtusa vel retusa, apice incurva, basi rotundata, incurva; labellum oblongum vel oblongo-lanceolatum, integrum, obtusum, patenti-deflexum, 1 cm. longum, 3·0–3·5 mm. latum; anthera resupinata; rostellum breve; ovarium obtuse triangulare. (Ex exempll. duobus vivis sub num. 4330 exsiccatis.)

Hab. In planitiebus arenosis prope Tygerberg, Nov., *P. Mac Owan* (*Bolus* 4330! in herb. Kew); prope Groenekloof, Oct., *Bolus* 4330!; Salt River prope Cape Town, *W. H. Harvey* 244!, in Herb. Kew.

The sepals are usually a dull leaden blue, sometimes nearly purple, the labellum dirty yellow variously marked with brown patches or in the form of a large cross, the leaves glaucous green with bands of red spots on the under surface near the base. The species is closely allied to *D. cornuta*, Sw., with which it has been confused in herbaria, resembling that species in colour, habit, and general aspect. The differences may be summed up as follows: the spike of our plant though dense is usually narrower than in *D. cornuta*; the bracts are narrower and more acuminate; the galea is acute though minutely notched (not obtuse); the spur

spreading for some distance (not immediately deflexed); the side sepals are narrower and more acute; the labellum exactly or nearly oblong (not broadly obovate); colour as above, while in *D. cornuta* it is invariably a deep velvety purple.

It is an interesting question whether this is the *D. macrantha* of Thunberg (Flor. Cap. ed. 1823, p. 8). It agrees with the description in the acute galea and the more spreading spur; but Thunberg says the spike of his plant is denser than in *D. cornuta*, the flowers slightly larger, and the labellum acute and carinate, which is not the case with our plant. Then there is the difficulty that there is no type of *D. macrantha* existing in Thunberg's herbarium, and no other plant so far as known which agrees with his description; while it is certainly desirable that our plant should be distinguished and published, a course I have thought best to adopt in spite of the suspicion I cannot avoid entertaining that this may be a form of Thunberg's species.

Lindley (Gen. & Sp. Orch. p. 349) said that *D. macrantha* was unknown to him; but the name was subsequently applied by gardeners to a very different plant, viz. *D. crassicornis*, Lindl. (*D. megaceras*, Hook. f. Bot. Mag. t. 6529), an Eastern Cape species. Under the latter number Hooker remarks:—"As to *D. macrantha* of Thunberg, it is clearly a species very near to *D. cornuta*, if not a variety of that plant; there are numerous specimens thus named in the Kew Herbaria, amongst them one from the Sands about Salt River, near Cape Town, collected by Dr. Harvey, who has appended to it a ticket with '*D. macrantha* of Thunberg. Differs from *D. cornuta* merely in its labellum. I cosnider it only a variety, yet its habit is different.' Whatever the difference of habit is, it is lost in the drying; for the specimen is in this state undistinguishable from *D. cornuta*, and, like it, has flowers not half the size of those of *D. megaceras*, with minute included petals."

I will only add that I have drawn both species from life and carefully compared them; and though I have only seen two living examples of the present plant at an interval of five years, I had no difficulty or hesitation whatever in distinguishing them from *D. cornuta*, the latter being extremely common.

DISA SCULLYI, *Bolus*, n. sp. Glabra erecta sequipedalis. Folia inferiora ligulata acuminata, basi arcte vaginantia, 10–12 cm. longa, 1·0–1·5 cm. lata, superiora sensim minora, ad vaginas ad-

pressas apicibus liberis reducta; spica cylindracea, sublaxiflora, 8–17 cm. longa, 2·5–3·0 cm. lata, bracteis lanceolatis, acuminatis, erectis, apicibus reflexis; galea infundibularis erecta, 1·1 cm. longa, calcare filiformi adscendente, apice interdum subincrassato, 3 cm. longo, aucta; sepala lateralia elliptica subobtusa, infra apicem valde apiculata, cum apiculo 1·4 cm. longa; petala lateralia oblonga, erecta, margine postico auriculato, antice ampliato, emarginato, vix 1 cm. longa; labellum anguste rhomboideo-lanceolatum vel lineari-lanceolatum, basi angustatum, obtusissimum, minutissime crenulatum, circa 1 cm. longum, 2–3 mm. latum. (Ex exempll. duobus exsiccatis ut infra.)

Hab. In uliginosis, Menziesberg, prope Stockenstrom, Regione Orientali Coloniæ Capensis, flor. Jan., legit *W. C. Scully*. (No. 5915 *Bolus* in herb. Kewensi, &c.) Caffraria, *Mrs. Barber* No. 23! in Herb. Kew.

The habit is straight and lanky with two or three leaves at base, and half a dozen close or little-spreading sheaths on the scape. The species comes next to *D. Cooperi*, Reichb. f., to which it is, perhaps, too nearly allied. Nevertheless, though it has sepals of a similar shape and nearly as large, it differs in the petals and labellum. The former in *D. Cooperi* are very fleshy and have no ear-like lobe on the back margin; the labellum is still more different in shape, and three times as large superficially as in this plant. Judging from my specimens the habit is also different; the present plant being less robust, the leaves fewer and narrower, and the spikes rather shorter and much less dense. The sepals appear to be rose-coloured, with darker veins.

As Prof. Reichenbach has not given the colours of *D. Cooperi*, I may quote them from a note by Mr. Tyson on his No. 1606:—"Galea and spur creamy, with pinkish sides; petals greenish yellow; labellum lemon-yellow. All the spurs lie uniformly pointing upwards along the rhachis. The flowers are strongly clove-scented."

Disa affinis, *N. E. Br.* (*in Gardeners' Chron.* 1885, vol. xxiv. p. 402). Erecta vel subdecumbens, 1–1½ pedalis; folium inferum ellipticum, subobtusum, multinervium, basi vaginans patens, 10–19 cm. longum, 5–6 cm. latum, superiora (1–2 vel rarius 3) sensim minora, acuta, mucronata, in bracteas abeuntia; scapus vaginis 4–5 submembranaceis arcte adpressis vestitus; bracteæ late ovatæ acuminatæ, membranaceæ, reticulato-venosæ, ovaria calcariaque laxe

amplectentes et iis parum breviores; spica sublaxa 8–12 cm. longa; sepalum dorsale limbo fornicato obtuso, 1 cm. longo, calcare filiformi dependente apice emarginato, 2·5 cm. longo, ovario parum longiore; sepala lateralia oblonga, subacuta, trinervia, patentia, 5–6 mm. longa; petala lateralia oblique ovata, subfalcata, pleraque emarginata, trinervia, galea parum breviora; labellum oblongum, nunc obtusissimum, nunc apice angustatum, 8–9 mm. longum; rostellum brachiis retroversis, stigma magnum prominens, antice rotundatum, supra convexum, vix superans, et ab eo lacuna quasi excavata sejunctum. (Ex exempll. plur. viv. sub num. 4555 distrib.)—Monadenia rufescens, *Lindl.*! *Gen. & Sp. Orch.* p. 356, excluding synonyms.

Hab. In rimis saxorum locisque umbrosis in montibus Peninsulæ Capensis, 1400–2500 ped., fl. Sept.–Oct. *Bolus* 4555, *Herb. Norm. Austr.-Afr.* 170; Clanwilliam, Drakensteenbergen et Genadendal, *Drège* 1252 *a*!, 1252 *d*!; *Zeyher* 3925!; Craggy Peak, Zwellendam, *Burchell* 7321, 7357; *Pappe* 52 *in herb. Lindl. &c.*

This is one of the most distinct species of this group, being readily known by its large broad lower leaves, its lax almost weak habit, and its pale colour both when living and in the dried state. The leaves are a sap-green, the sepals sulphur-yellow, the petals bright golden. The column is also well marked, the stigma being large and bossy with a deep depression between it and the rostellum. The sepals are thin, the petals thicker but scarcely fleshy as in most of this section. It loves the steep sides of rocky hills or crags which are turned away from the sun.

Disa pygmæa, *Bolus*, n. sp. Erecta, glabra, pusilla, 4·5–9 cm. alta; caulis e basi gracili foliosus; folia infima 1–2 in vaginas reducta, superiora 3–5 ovata acuta, vel rarius lanceolata acuminata, basi vaginantia, erecto-patentia, obscure 3–5-nervata, 1·5–2·5 cm. longa; spica densa, 8–24-flora, longitudine fere totius plantæ; bracteæ nunc ovatæ obtusæ floribus æquilongæ, nunc lanceolatæ acuminatæ flores superantes; flores cum ovario 7–9 mm. longæ; galea oblonga, obtusa, apiculata, calcare tereti, incurvo, obtuso, sæpe subinflato, 2–3 mm. longo, ovario breviore, galea cum calcare 7 mm. longa; sepala lateralia ovata, obtusissima, patento-recurva, 4–5 mm. longa; petala lateralia subtriangularia acuta, angulo postico obtuso longitudine fere galeæ; labellum oblongum obtusum, basi angustatum, deflexum, 2·5 mm. longum; rostellum stigma breve rotundatum superans, processubus latera-

libus antheram versus omnino reflexis ; caudiculæ elongatæ polliniis æquilongæ ; ovarium breve obovatum, pustulis hyalinis obtectum, 3 mm. longum. (Ex exempll. viv. 11 sub num. 4970 distrib.)

Hab. In arenosis montis Muizenberg [Montis Steenberg, in Herb. Kew.—N. E. B.] Peninsulæ Capensis septentrionem versus, alt. 1500 ped., fl. Nov., legit *A. Bodkin. Bolus* 4970 ! in Herb. Kewensi &c.

The sepals are a dull red, the petals and labellum pale yellow. Allied to *Monadenia micrantha*, Lindl., from which it differs by its smaller size, greater relative length of spike, broader back sepal, rounded side sepals, wider labellum which is not thickened at the apex, differently shaped and not fleshy side petals, higher rostellum, longer caudicles of the pollinia (which are almost absent in *M. micrantha*), rounded stigma, and, lastly, its shorter ovary covered with pustules. The spur is variable, but usually shorter, thicker, and more curved than in *M. micrantha.* I rely chiefly upon the differences in the column, for *M. micrantha* is itself a variable species in respect of size, bracts, and spur ; yet I have never seen any small specimens of that species which resemble this.

Disa reticulata, *Bolus*, n. sp. Erecta vel subdecumbens, glabra, 10–30 cm. alta ; caulis foliosus basi sæpius gracilis ; folia inferiora lineari-lanceolata acuminata, basi vaginantia, erecta, superiora sensim minora ovato-lanceolata, basi spicæ parum longiora ; spica sublaxa, longitudine circiter dimidium plantæ ; bracteæ late ovatæ, acumine longo torto præditæ, membranaceæ, reticulato-venosæ, floribus parum longiores, ovarium cum calcare involventes ; flores cum ovario 1·8 cm. longi ; galea obovata obtusa 8 mm. longa, calcare filiformi acuto, 1 cm. longo, ovario parum breviore ; sepala lateralia oblonga obtusa, deflexa, obscure trinervia, 6 mm. longa ; petala falcato-ovata, subacuta, carnosa, 5 mm. longa ; labellum linguæforme, obtusum, carnosum, deflexum, 5–6 mm. longum ; rostellum erectum, latius quam longius, utrinque tuberculatum, fissura inter rostellum et stigma tenui ; stigma breve obtusum ; ovarium 1–1·5 cm. longum. (Ex exempll. viv. 8, sub num. 4988 distrib.)

Hab. In humidis montis Constantiæ, in Peninsula Capensi, alt. 2000 ped., flor. Dec. *A. Bodkin, Bolus* 4988 !, in clivis montis Tabularis, alt. 2800 ped., flor. Dec., *Bolus* 4897 !

The flowers have a yellowish ground colour with dull red on the edges, back of galea, &c., the labellum and the whole flower

sometimes darker; leaves a dark green. The species is distinguished by its usually slender stem (though stouter specimens occur), and especially by its very broad membranous reticulately-veined bracts, low rostellum, and shallow cleft between that and the stigma. On the Cape Peninsula at least, it is exclusively a mountain-plant.

Disa lineata, *Bolus*, n. sp. Erecta, glabra, laxe foliosa, 3–9 pollicaris; folia 5–6, linearia acuta, adscendentia, basi vaginantia, 3–6 cm. longa, superiora sensim in bracteas abeuntia; spica subdensiflora (6–20-flora), cylindrica, bracteis ovato-lanceolatis acuminatis, erecto-patentibus, flore plerisque brevioribus; flos cum ovario circa 1·3 cm. longus; sepalum alterum posticum galeatum, erectum, acutum, margine subpatenti undulatoque, basi obtusissimum (non calcaratum nec saccatum), 9 mm. longum; sepala lateralia oblonga acuta, patentia, 7 mm. longa; petala lateralia oblique oblongo-falcata, reclinata, apice incurva, dentata, basi columnæ adnata, 5 mm. longa; labellum e basi lata lanceolatum acuminatum, integrum vel obsolete crenulatum, apice recurvum, 5 mm. longum; anthera reflexa; rostelli brachia erecta, parallelia, cum glandulis arcte approximata, basi utrinque tuberculata; stigma amplum; ovarium cylindraceum 6–8 mm. longum. (Ex exempll. plur. viv. sub num. 7001 distrib.)

Hab. In clivis humidis montis Constantiæ in Peninsula Capensi, alt. circ. 2700 ped., fl. Sept.(–Oct.), legit *A. A. Bodkin*. *Bolus* 4966!, 7001! in Herb. Kew. &c.

The sepals are a tawny yellow, the galea marked by definite purple lines much in the manner of *Satyrium lineatum*, Lindl., and somewhat like the galea of that plant in general appearance. The petals have dark purple tips, the labellum a large deep red-purple centre with a yellow tip. The species comes near to *D. neglecta*, Sond.; but Mr. N. E. Brown informs me that the flowers are two diameters larger than in that species, of which the lip is described as narrow linear and as long as the sepals, while in our plant it is shorter and nearly ovate.

Disa Bodkini, *Bolus*, n. sp. Erecta, robusta, glabra, 6–18 cm. alta; caulis foliosus sæpe flexuosus; folia 6–8, e basi lata linearia acuminata, basi vaginantia, erecta, gracilia, flexuosa, 6–10 cm. longa, suprema inflorescentiam superantia; bracteæ late ovatæ acuminatæ, floribus æquilongæ; flores 1–6, corymboso-capitatæ, capitulis majoribus 5 cm. latis, post anthesin sæpe in spicam brevem productis

sepalum alterum anticum cucullatum quasi medio deflexum, vix galeatum, apice angustatum, leviter emarginatum, 1·5 cm. longum; sepala lateralia ovato-elliptica, subacuta, concava, erecto-patentia, 1–6 cm. longa, 1 cm. lata; petala lateralia oblonga subfalcata, obtusa, carnosa, recurvato-adscendentia, 7 mm. longa; labellum oblongum, obtusissimum, carnosum, adscendens, 1 cm. longum, 5 mm. latum; rostellum erectum, brachiis parallelis approximatis; anthera leviter recurvata; ovarium rectum, 1 cm. longum. (Ex exempll. plur. viv. sub num. 4968 distrib.)

Hab. In humidis montis Tabularis prope Cape Town locis pluribus, alt. 2200–2800 ped., mense Nov. (anno 1884) legit *A. Bodkin. H. Bolus* No. 4968! in Herb. Kew; Herb. Norm. Austr.-Afr. No. 333!

The colour of the sepals is a dull red, the petals and labellum deep purple in the middle with orange tips. Its nearest congener is *D. Melaleuca,* Thunb.; but it greatly differs from that by its relatively much larger odd sepal, its wide obtuse labellum, and otherwise, so that there is little probability of confusion even in the dried state; in a living state their appearance is widely different. The base of the stem is sometimes surrounded with the fibres of old leaves.

Pterygodium magnum, *Reichb. f. in Flora,* anno 1867, p. 117. —This species was very briefly described *ex sicco* and without any published locality, or other indication of its origin. The author had under his hands a single specimen sent to him by Prof. MacOwan, which was returned with this name attached in the author's hand-writing. It is probably the type specimen, but certainly an authenticated one. As I have seen this, and also one other, and have had the advantage of examining it from flowers freshly preserved in spirit, I venture to append a fuller description:—

Erectus, validus, glaber, 60–70 cm. altus; scapus dense foliosus; folia lanceolata, obtuse acuta, basi vaginantia, superiora angustiora, acuminata, 15–20 cm. longa, ad basin spicæ attingentia; spica dense multiflora, 20 cm. longa, 4 cm. lata; bracteæ subulatæ vel anguste lanceolatæ, infimæ flores multo superantes (in exempl. MacOw. 5–6 cm. longæ), superiores ovario æquilongæ; flores expansi ambitu fere orbiculares 1·2 cm. diametro; sepalum dorsale oblongo-lanceolatum acutum, 9 mm. longum; lateralia æquilonga, subconformia, magis concava, parum obliqua; petala

lateralia cuneato-flabellata, marginibus superiori et anteriori fimbrillatis, multinervia, circa 9 mm. longa; labellum exacte flabellatum, petalis margine anteriori multo minus fimbrillatis, appendice magno, cucullato, suberecto, media antice fisso, galea *Disperidis cucullatæ* fere instar; columna hippocrepica, glandulis polliniorum antice subapproximatis; ovarium gracile, 3·5 cm. longum. (Ex exempll. duobus exsicc. ut supra.)

Hab. In summo monte Kagaberg, 5000 ped., fl. Febr. *MacOwan*, in herb. Gub. Capensi; ad ripas rivuli monte Currie, Griqualand East, 5100 ped., Febr., legit *Domina P. Brownlee*, *Tyson* No. 1604 in herb. Bolus.

The habit is entirely that of *Pt. inversum*, Sw., and very different from that of *Pt. venosum*, Lindl., to which Prof. Reichenbach compares it, probably by a slip of the pen, or typographical error. The curious appendage of the labellum is different from anything else in the genus; the column most resembles that of *Pt. carnosum*, Lindl.; but the glands of the pollinia are nearer together. Tyson's No. 1604 is less robust and shorter than MacOwan's, but in all essential characters it agrees exactly. To the last-named gentleman I am indebted for flowers preserved in spirit.

[The Kew Herbarium contains the following specimens of this fine species, which, according to Mr. Hutton, "grows to 5 feet in height, flowers green, striped with light red; January; soft tubers like *Disa*, leaves thick and succulent."—Kagaberg, 3000 ft., *Hutton*!, Natal, *Wood* 909!, *Cooper* 3621!, *Mrs. Fannin*!; Nottingham, Natal, *Buchanan*! Some of these specimens are between 3 and 4 feet high.—N. E. B.]

Disperis oxyglossa, *Bolus*, n. sp. (Pl. I. figs. 6–12.) Erecta, gracilis, glabra, 20–25 cm. alta; folia 2–3, oblonga acuta, basi vaginantia, 2–3 cm. longa, 6 mm. lata, internodiis 4–5 cm. longis; racemus laxe 2–3-florus; bracteæ ovatæ acuminatæ, complicatæ, ovario subæquilongæ; sepalum dorsale fornicatum, apice longe acuminato, 1·6 cm. longum; sepala lateralia lanceolata acuminata, arcuato-patentia, 1·6 cm. longa, infra medium calcari obtuso 5 mm. longo aucta; petala lateralia sub galea agglutinata, eaque subæquilonga unguiculata, oblique lanceolata acuminata, margine anteriori lobo auriculæformi prædita; labellum basin versus lineari-unguiculatum, ima basi columnæ adnatum, deinde bipartitum, labiis valde divergentibus, labio antico lanceolato acuminato, semi-complicato,

arcuato-porrecto, basi intus minute tuberculato, labio postico breviori, lineari, angustissime cymbiformi, obtuso, utrinque ala late triangulari hyalina decurrente instructo. Ex exempll. 2 exsicc. ut infra.

Hab. In lat. australi montis Currie supra cataractam, ditione Griqualand East, C. B. S., alt. circa 5500 ped., flor. Febr., legit *W. Tyson* No. 1603! in herb. meo. Natal; heights above Karkloof, *J. Sanderson* No. 1071. Kaffraria; mountains, in rather damp localities, *Mrs. Barber* No. 28; Baziya mountain top, 4000 ft. alt., fl. Feb., *Baur* No. 813.

The species is characterized by its long, narrow, shallow, and taper-pointed back sepal, and by the shape of its labellum. It comes near to *D. Wealii*, Reichb. f.*, and the habit is similar. It differs from that by its more robust habit, larger and more taper-pointed flowers, by the anterior lobe of its labellum being longer (not shorter) than the posterior lobe, and by the posterior lobe being winged and differently shaped. In the dried state it might easily be confused with it.

DISPERIS MACOWANI, *Bolus*, n. sp. (Pl. I. figs. 13–17.) Erecta, pusilla, 9–15 cm. alta; folia duo, patula, ovata acuta, cordato-amplexicaulia, ciliolata, obscure reticulato-venosa, ex sicco submembranacea, 1·2–1·5 cm. longa, 1·0–1·4 cm. lata, infimum nunc humistratum, nunc caulinum, internodio 2–3 cm. longo; scapus pergracilis, 1-florus, hispidulus, bractea foliacea, foliis conformi, 6 mm. longa, ovario breviori; sepalum dorsale galeatum, 6 mm. altum, apice acuto porrecto; sepala lateralia ambitu lanceolata,

* [In habit and general appearance this species appears to me far more nearly to resemble *D. paludosa*, under which name it has been distributed by Mr. Baur, but is readily distinguishable from that species by its larger flowers, more acuminate galea, and a very different lip. The flowers are purple with some green warted spots on the petals. Of this species I have made fresh drawings of analyses, and substituted for those originally sent by Mr. Bolus. Figs. 6, 8, 9, 11, & 12 were made from Mr. Bolus's type specimen (Tyson 1603), which he kindly sent to Kew for my inspection, and figs. 7 and 10 were drawn from Baur's specimen No. 813, which exhibits a decided difference in the shape of the dorsal sepal, although the lateral sepals and lip are the same as in Tyson's plant. Sanderson's and Mrs. Barber's specimens are also like that of Baur, but as I do not notice any other difference, I think they can scarcely be regarded in any other light than as conspecific with Tyson's plant. The dorsal sepals are shown sideways and pressed flat. The petal, fig. 10, is shown with its claw in its natural position, whilst in 9 it is pressed flat in a line with the limb, which is shown pressed flat in both 9 and 10.—N. E. BROWN, Kew.]

patula, apice deflexa acuta, 4·5 mm. longa, medio calcare obtuso sub apice extenso nec dependente, 2 mm. longo, aucta; petala lateralia sub galea agglutinata, lanceolato-falcata, margine anteriori basin versus lobo rotundato prædita, 5–6 mm. longa; labellum 7·5 mm. longum, antheram multo superans, e basi lineare, in laminam rhomboideam expansum, deinde dente lacinula retrorsa apice acuto recurvo in pagina anteriori, tum denique in processum filiformem subcarnosum papilloso-hispidulum productum apice trilobum, lobis obtusis incurvis; rostelli brachea acuta; ovarium circa 1 cm. logum. (Ex exempll. 2 exsicc. ut infra.)

Hab. Ad ripas rivuli ad lat. montis Boschberg pone Bester's Hoek, Somerset East, Colonia Capensi, alt. circa 4500 ped., æstate anni 1880 legit *P. MacOwan* No. 2626! (in herbb. Kew et Bolus). [In rupibus prope Grahamstown et in monte Boschberg, 2000–4000 ped., flor. Decemb., *MacOwan* No. 807! in Herb. Kew; two small specimens 2½ inches high.—N. E. BROWN.]

Colour of the flowers "pale bluish" (this being very unusual in the genus as far as my experience goes), the side petals with a few greenish spots. The affinities of the species are with *D. Woodii*, mihi. The labellum, which is the great mark of distinction in all the Disperids, is of a similar type, but quite different in detail, besides which all the other parts of the perianth differ. We have but two plants, all that Mr. MacOwan, who so diligently explored that fine region, ever found. Nevertheless, we hope to get it again from some of our younger friends who are collecting in the mountains of the Eastern districts.

DISPERIS WOODII, *Bolus*, n. sp. (Pl. I. figs. 18–22.) Erecta, pusilla, glabra, 5·0–7·5 cm. alta; folia duo, radicalia, ovata acuta, cordato-amplexicaulia, undulata, reticulate-venosa, 1·5 cm. longa, 1 cm. lata; scapus gracilis, aphyllus, uniflorus; bractea ovata subobtusa, ovario brevior; sepalum dorsale altigaleatum vel in calcar extinctoriiforme adscendens productum, basin versus inflatum, antice acutum, porrectum, 1·0–1·5 cm. longum; sepala lateralia deflexa, lanceolata acuminata, 6 mm. longa, saccis brevibus obtusis aucta; petala lateralia subrhomboidea acuta, sub galea agglutinata; labellum in fundum galeæ extensum, 8–9 mm. longum, e basi lineare, lacinula cordata, retrorsa, foliacea, acuta, decurva in pagina anteriori, postice caruncula perulæformi (nectariferi ?) præditum, deinde sursum filiforme, apice bifidum, lobis approximatis obtusis. (Ex exempll. 4 exsicc. ut infra.)

Hab. In colle graminoso, Inanda, Natal, alt. 2000 ped., flor. Aprili, *J. M. Wood* No. 127 !* ; Natal, *J. Sanderson* No. 1010 !

The sepals are a pretty rose-pink with darker markings, the petals with pale green dots in front ; the scape is reddish, and the leaves dark green with pale reticulated veins. The galea is somewhat variable in length. From Mr. Wood's excellent specimens I have been enabled to ascertain the form of the labellum with a fair approach to correctness ; and I have further had the advantage of seeing a finely executed drawing by Miss A. Clarke from the living plant, which that lady very kindly sent to me. Altogether this species is a little floral gem.

Disperis purpurata, *Rchb. f.*, var. parviflora, *Bolus.* Gracilior, hirsutior, 8–20 cm. alta ; folia laxiora ; flores dimidio fere minores ; galea compressa ore angustiora (anguste elliptica) ; sepala lateralia saccis pro magnitudinem longioribus ; petala lateralia latiora ; labellum angustius.

Hab. In arenosis, prope Groene Kloof, alt. circa 300 ped., flor. Oct., *Bolus* No. 4337 ! ; prope Stellenbosch, *Sanderson* No. 937 ! (in Herb. Kewensi).

[The flowers are white according to Mr. Sanderson.—N. E. Brown.]

Disperis Tysoni, *Bolus,* n. sp. (Pl. I. figs. 28–33.) Glabra, erecta, pedalis vel ultra ; scapus rectus, rigidiusculus, laxe foliosus ; folia 4–5, ovato-lanceolata acuta, basi amplexicaulia, 2·0–2·5 cm. longa, 1 cm. lata, internodiis 4–7 cm. longis ; spica laxe 12–20-flora, 10–12 cm. longa ; bracteæ ovatæ acutæ, complicatæ, fere erectæ, ovariis subæquilongæ ; galea cucullata, subconica, obtuse acuta, fundo obtusissimo, 9 mm. longa ; sepala lateralia circumscriptione anguste lanceolata acuminata, concava, medio sacco brevissimo aucto, 7 mm. longa ; petala lateralia falcato-spathulata acuta, margine anteriori tuberculato, circa 4 mm. longa ; labellum basin versus lineari-unguiculatum, ima basi columnæ adnatum, deinde bipartitum, lobo antico triangulari acuto, margine reflexo, intus tuberculato, lobo postico longiori, subulato, obtuso, resupinato ; rostelli brachia glandulifera brevia. (Ex exempll. 2 exsicc. sub num. 1079 Tyson ; floris partes ex spec. in spir. vini asservatis.)

Hab. In uliginosis prope Kokstad, Griqualand Orientalis, alt. 5000 ped., Jan., legit *W. Tyson* No. 1079 ! in Herb. Kew, &c. ;

* [The specimens of Wood, No. 127 at Kew, are from "Noodsberg, Natal, May."—N. E. Brown.]

Somerset East, *MacOwan* 521; Caffraria, in humidis clivis montis Baziya, alt. 2000 ped., flor. Mart. Apr., *Baur* 151!

The species is allied to *D. Cooperi*, Harv. Thes. Cap. ii. t. 172 *; and must also be allied to *D. stenoplectron*, Reichb. f. (which the author says is very near to *D. Cooperi*, Harv.), but differs from that by its galea being cucullate, not fornicate, and obtusely acute, not acuminate; also by the posticous lobe of its labellum being narrower, not wider, than the anticous lobe. In this species, as in *D. secunda*, *D. cucullata*, the apex of the anterior lobe of the labellum is closely fitted to and under the apical point of the galea.

DESCRIPTION OF PLATE I.

South-African Orchids. Floral parts of species of *Disperis*.

A. Figs. 1–5. *Disperis Wealii*, Reich. f.
B. ,, 6–12. —— *oxyglossa*, Bolus, n. sp.
C. ,, 13–17. —— *Macowani*, Bolus, n. sp.
D. ,, 18–22. —— *Woodii*, Bolus, n. sp.
E. ,, 23–27. —— *namaquensis*, Bolus.
F. ,, 28–33. —— *Tysoni*, Bolus, n. sp.

The figures are numbered consecutively in the Plate, but the following small letters apply similarly to each species :—

a. Galea, or back sepal, side view.
b. Side sepal, front view. } Enlarged 3 diameters.
c. Side petal, side view. }
d. Labellum, side view. } Enlarged 6 diameters, except in *D. oxyglossa*, which are ×3 diam., and *D. Tysoni*, which are ×4 diam.
e. Ditto, front view. }
f. Ditto, front oblique view. }
g. Ditto, in front and from above. }

In the side petals the median nerve shows the line of attachment to the galea; the anterior or free portion is generally marked by coloured spots; in *D. oxyglossa* it is to the right; in *D. Wealii* to the left.

Nearly all the figures are drawn from dried specimens of actual types. In the case of *D. oxyglossa*, figs. 6, 8, 9, 11, and 12 are drawn from Tyson's plant No. 1603, and figs. 7 and 10 from Baur's specimen No. 813. In fig. 9 the claw is straightened out in a line with the limb; and in fig. 10 it is shown more in its natural position, although the limb is flattened out, not arched, as it would be when in its natural position.

Figs. 23-27 (*D. namaquensis*) are drawn from living specimens. Figs. 28-33 (*D. Tysoni*) have been drawn from flowers preserved in spirit, viz. specimens of Tyson's No. 1079, which were compared by me, and found to agree with specimens of MacOwan's No. 521, which had been marked "*D. Cooperi*, Harv.," by Prof. H. G. Reichenbach. Fig. 33 is viewed from above, the anterior lobe being pulled down to show the upper surface.

[* The flowers of *D. Cooperi*, Harv., are twice as large, and not nearly so numerous, as those of Mr. Bolus's new species *D. Tysoni*.—N. E. Brown.]

A Contribution to the Study of the Relative Effects of Different Parts of the Solar Spectrum on the Transpiration of Plants. By the Rev. George Henslow, F.L.S.

[Read 3rd December, 1885.]

Introduction.—The conviction that light is an important factor among the causes of the phenomena of plant-growth has long been held; but it is only within the last twenty years that satisfactory experiments have been made to ascertain the relative effects of different rays of light upon transpiration. Sachs, in his 'Physiologie Végétale'*, says:—"La lumière est un des agents qui agit le plus efficacement sur la transpiration. Mais on ne peut pas dire positivement si elle agit par elle-même, ou par son union intime avec une élévation de température."

That author repeats this opinion in his 'Text-book' †:—"It is still doubtful whether light, *i. e.* radiation as such, independently of the elevation of temperature caused by it, influences transpiration." He subjoins the footnote, "Dehérain's researches ‡ do not decide the question."

Prof. Daubeny in 1836 carried out some experiments with coloured lights, but forbore to give any numerical results, as he met with some apparent anomalies §. He came, however, to the conclusion that "the processes [the exhalation of moisture from the leaves, and the absorption of it by the roots] are probably dependent on the combined action of heat and light, coupled with those mechanical influences which operate upon dead as well as upon living organic matter" ‖.

Although the glasses used in his experiments were not tested by the spectroscope, he appears to have come to some conclusions very nearly the same as those arrived at by the latest observers, *e.g.* Wiesner; yet he thinks that they are exceptional instead of being the rule, as the latter believes them to be. "Now, although the experiment," he adds, "tended to show that the extrication

* P. 250 (1868). † Second English ed. (1882) p. 678.

‡ Ann. des Sci. Nat. sér. 5, xii. (1869), p. 1.

§ Sachs remarks as follows on Daubeny's experiments:—"Ch. Daubeny, qui s'est occupé de cette question, ne s'exprime qu'avec une extrême prudence, et ses observations ne paraissent pas l'avoir conduit à des résultats positifs."—Phys. Vég. p. 251.

‖ Phil. Trans. 1836, i. p. 159.

of moisture, *cæteris paribus*, was most abundant in proportion to the intensity of the light admitted (orange glass in general causing more moisture to be exhaled than red or green), yet in some instances blue and purple glasses, and, still more remarkably, bottles filled with the cupreous solution [ammonio-sulphate of copper] would cause a more abundant exhalation than orange or even transparent glass. Here, however, another principle seems to come into play, namely, the influence of heat radiated from the surface of the screen" *.

Dehérain's researches alluded to above were made upon leaves in a saturated atmosphere, and he came to the following conclusions, amongst others † :—

"1°. L'évaporation de l'eau par les feuilles est déterminée par la lumière et non par la chaleur.

"2°. Cette évaporation se continue dans une atmosphère saturée.

"3°. Les jeunes feuilles évaporent plus d'eau que les anciennes.

"4°. Les rayons lumineux (jaune et rouge) efficaces pour déterminer la décomposition de l'acide carbonique, sont aussi ceux qui provoquent l'évaporation la plus abondante.

"5°. La différence d'action des divers rayons lumineux est encore sensible quand on s'efforce de les amener à une intensité lumineuse égale."

The coloured fluids used by M. Dehérain were as follows:—

"1. Dissolution rouge de carmin dans l'ammoniaque.

"2. Dissolution jaune de chromate neutre de potasse.

"3. Dissolution verte de chlorure de cuivre.

"4. Dissolution bleue de sulphate de cuivre ammoniacal.

"5. Dissolution violette d'iode dans le sulfure de carbone."

The quantity of water "evaporated" in one hour by a leaf of Barley, reduced to percentages of the whole weight of the leaf, was as follows:—Red 93·6 p. c., yellow 63·4, green 5·8, blue 6·3, violet ·05.

The relative *intensities* of the rays, however, were not estimated in any way. Nor were the lights tested by the spectroscope—a most important and, in fact, necessary procedure; as it is pretty certain that they were not monochromatic ‡.

* Phil. Trans. 1836, i. p. 160. † Ann. Sci. Nat. sér. 5, xii. (1869) p. 23.

‡ A violet glass of a peculiar reddish tint in my possession transmits *the whole of the spectrum*, and is therefore useless for experimental purposes.

Wiesner's * researches led him to draw different conclusions from those of M. Dehérain, in that it is not the (optically) brightest part of the spectrum, but those parts which correspond to the absorption-bands of chlorophyll, which are mainly concerned in the process. Later observers, including myself, tend to confirm his views.

A fact of importance, to which he early calls the reader's attention, is the chief difficulty in carrying out experiments successfully, from the ever-varying amount of light (not pure sunshine). He illustrated this by the following experiment. He chose young plants of Maize, having their roots in water, protected above by a layer of oil to prevent evaporation. He placed them in one scale of a balance in equilibrium. He then removed 10 milligrammes; and as soon as the scales were again in equilibrium he removed 10 more, and so on. Equilibrium was successively restored after the periods of 6 min. 15 sec.; 7,15; 4,30; 4,20; 7,45; and 5,10. The temperature and humidity were constant. Hence the variations of transpiration could only be accounted for by the unequal illumination of the sky caused by passing clouds.

He also adds several experiments showing the great differences which result between the effects of bright sunshine, diffused light, gas, and in obscurity, and concludes with the remarks:—"Dans tous les cas, ces quelques expériences montrent qu'on s'expose à de graves erreurs quand on étudie l'action de la lumière sur la transpiration sans tenir compte des changements de l'éclairage."

Unfortunately the intensity of light is just the one thing which at present it is impossible to estimate.

The next point of importance to which Wiesner draws attention is the part which the ultra-red calorific rays play as a cause of transpiration. Alluding to M. Dehérain's experiments he says †:—"M. Dehérain a exposé une plante dans l'air saturé derrière une solution d'iode dans le sulfure de carbone qui ne laisse passer que les rayons calorifiques obscurs, et il en conclut que dans ces conditions, les rayons obscurs sont pour ainsi dire sans effet sur la transpiration.

"J'ai fait moi-même deux séries d'expériences avec de jeunes Maïs et des rameaux d'If. Seize expériences à la lumière solaire

* "Recherches sur l'influence de la lumière et de la chaleur rayonnante sur la transpiration des plantes," par M. J. Wiesner, Ann. des Sci. Nat. sér. 6, iv. (1876), p. 145.

† Ann. Sci. Nat. sér. 6, iv. (1876) p. 159.

et à la lumière du gaz m'ont conduit à ce résultat: *que les rayons calorifiques obscurs agissent très-fortement sur la transpiration, et que cette influence, relativement à celle des autres rayons du spectre, est plus grande quand on se sert de la lumière du gaz que quand on opère à la lumière solaire*"*.

After detailing his methods of experiment he concludes:—"Il y a entre la valeur calculée de la transpiration à l'obscurité et la valeur observée une différence de 11 pour 100.

"En passant sur ces erreurs d'expériences, on trouve d'une manière approximative que pour 100 d'eau transpirée, 79 reviennent aux rayons lumineux et ultra-violets, et 27 aux rayons calorifiques obscurs."

It is worth while to recall the fact that Daubeny in 1836 perceived the importance of heat-rays. He attributed the excess of transpiration under blue, purple, and the cupreous solution, in great part to the heat radiated from the screen, for "a bottle filled with water, blackened with ink to such a degree as to transmit just as much light so far as could be measured by the eye, as that filled with the copper solution was found to do, caused an equally considerable amount of water to be evolved by the plant . . . Now as water, with the addition of a little ink, is known to absorb the rays proceeding from all parts of the spectrum in an equal ratio, it follows that the effect produced in either instance must be ascribed to the heat radiated, and not to any peculiar virtue of the violet extremity in stimulating the vegetative functions."

"Yet," he concludes, "the presence of some light seems essential to the due continuance of the process"†.

* "La flamme du gaz donne bien plus de rayons calorifiques que de rayons lumineux (Tyndall)."

† Ann. Sci. Nat. sér. 6, iv. (1876) p. 160. I am not aware of any other attempts to ascertain the exact amount of difference between evaporation, due to heat alone, and to transpiration, due to light. From some experiments (not yet sufficient for publication) I have found very marked differences in the amount of water lost in the same times and conditions, as well as in the *rapidity* with which desiccation takes place under the two processes. Such, at least, was found to obtain when one half of a living leaf transpired under sunlight; while the other half, *having been suddenly killed by scalding*, could only evaporate. I hope to be able to differentiate these two processes more accurately on a future occasion. An important paper indirectly bearing upon this subject is one by M. Maquenne, entitled, "Recherches sur la détermination des pouvoirs absorbants et diffusifs des feuilles" (*Annales Agronomiques*, tom. 6, 1880, p. 321).

A discovery of Maquenne's (which would seem to furnish an important aid

In ascertaining the amount of transpiration induced by different rays of the spectrum, Wiesner adopted two methods: first, by placing the plant in certain rays of the spectrum itself; and, secondly, under coloured fluids. The results were mutually corroborative.

The following were the results by the first method:—Red gave 136 milligr. per hour; yellow-orange, 122; blue, 146; ultra-violet, 70; obscurity, 62. He next compared these results with others from leaves placed as accurately as possible in the parts of the spectrum corresponding with the absorption-bands of chlorophyll. These latter gave the following results:—

Red (with absorption-band No. I.)	34·3	milligr.	per hour.
Yellow-orange (between bands II. and III.)	32·0	„	„
Green (between IV. and V.)	30·4	„	„
Blue (corresponding to band VI.)	38·7	„	„

From this he concludes:—"Il est donc bien évident que ce ne sont pas les rayons les plus lumineux, les rayons jaunes, qui favorisent le plus la transpiration; mais que celle faculté est répartie dans tout le spectre, de telle manière que les rayons les plus actifs sont précisément ceux qui correspondent aux sept bandes noires du spectre de la chlorophylle.

"Il est curieux d'observer la plus forte transpiration dans les rayons qui correspondent à la bande VI. M. von Wolkoff a fait voir récemment* que c'est dans cette partie du spectre chlorophyllien que se fait la plus puissante absorption de lumière.

"Les parties du spectre situées entre les bandes d'absorption, et qui sont toujours plus ou moins obscurcies par le passage à travers une solution de chlorophylle, ne sont pas sans action sur la transpiration; mais cette influence est inférieure à celle des rayons complètement éteints dans cette solution"†.

That the presence of chlorophyll is intimately connected with transpiration is clear from the different results obtained by

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to distinguish between the two processes evaporation and transpiration) is that older leaves absorb more heat than the younger ones of the same kind, and evergreens more than deciduous leaves; yet, according to Dehérain, it is exactly the reverse which transpire the most. Hence, if this function be identical with the purely physical process of evaporation, it would be difficult to reconcile the above fact with it.

* 'Die Lichtabsorption in den Chlorophylllösungen:' Heidelberg. 1876.

† Ann. Sci. Nat. sér. 6, iv. (1876), p. 169.

Wiesner with etiolated and green plants as well as from those obtained with coloured flowers, to which the reader is referred for further information*.

My object in pursuing analogous experiments to those of Wiesner was to try to test his conclusions, using, however, coloured glasses instead of fluids; and the results I have obtained all tend to corroborate his.

It is impossible to ascertain absolutely the amount of water transpired which is due to any particular band of colour in the solar spectrum; for the difficulties are insuperable. To say nothing of other influences at work to aid in the elimination of water, such as external and internal variations of temperature, dryness of the air, and above all, variations in the intensity of sunlight, it is impossible to get glasses monochromatically pure in any colour excepting red. Hence the results cannot be more than relative or approximately true. Such as they are, however, I find, like Wiesner, that the largest amount of water transpired is coincident with those parts of the spectroscope wherein lie the strongest absorption-bands of chlorophyll.

Character of the Coloured Glasses.—Before giving the results of my experiments, it will be desirable to describe the character of the glasses employed.

Red. This is a pure monochromatic ruby-red, which transmits no other rays whatever besides red light; and it is that portion of the spectrum which contains the very strong chlorophyllian absorption-bands Nos. I. and II. The thickness of the glass is one tenth of an inch.

Yellow. This glass passes not only the yellow, but all the red and green rays as well, up to F in the blue; but stops the rest

* Ann. Sci. Nat. sér. 6, iv. (1876), p. 157. For additional information corroborative of Wiesner the reader may consult 'Memorie della Reale Accademia dei Lincei' (1879-80), and an abstract in 'Comptes Rendus,' xci. p. 6, Aug. 9th, 1880, the general conclusions of which are as follows:—"Apart from, and in addition to, other factors which promote evaporation, the actinic influence of light largely affects transpiration in plants. Plants transpire more in light than in darkness, and more in proportion to the intensity of the light. The effect is therefore most marked just after midday. Only the portion of light absorbed produced this effect; consequently highly coloured plants are more affected than others. Plants transpire least in monochromatic light than in their own colour, and most in the complementary colour. Thus, a green leaf transpires least in green and most in red light, other conditions being the same." (*Hort. Journ.* 1880.)

of the most-refrangible half of the spectrum. As this glass not only transmits yellow and green which contain the fainter chlorophyllian bands II., III., and IV., but the powerful one No. I. as well, one would, on *à priori* grounds, infer that *more*, and not *less*, transpiration would occur with yellow glass than with red; but such is not usually the case. Moreover, the loss of water under ordinary clear colourless glass (one twelfth of an inch in thickness) is sometimes less than under either red or violet glasses alone; so that from these facts one is led to infer that the presence of the brightest or yellow rays is an actual impediment to transpiration, or in some way hinders the action of the red and violet. The thickness of the yellow glass used is one twelfth of an inch.

Green. This excludes red and violet rays, but transmits light which includes the position of the chlorophyllian bands III., IV., V., and VI. It is one twelfth of an inch in thickness.

Blue. This has the red end greatly subdued, appearing quite black in diffused light; but in direct sunlight a broad black band is seen in the midst of a small quantity of dull red. It includes green; but a black band in the position of the chlorophyllian band No. IV. Hence the glass transmits light which would include the bands No. V., VI., and VII. The thickness of the glass is one tenth of an inch.

Violet. This passes less green, but rather more red, than the blue glass. The light transmitted would include bands Nos. II., V., VI., and VII. A dark absorption-band occurs about the position of No. IV.

Clear. Ordinary transparent colourless glass, of a thickness of one tenth of an inch.

NATURE OF EXPERIMENTS.—In commencing my experiments I at first employed cut shoots and detached leaves of various plants, as has so generally been done by previous experimenters. In every case they were weighed both before and after their exposure for definite periods to daylight transmitted through the coloured glasses. Different methods were adopted; but the most satisfactory for short periods, such as are indeed only possible with detached specimens, was to cut the shoot under distilled water, inserting it in a small test-tube submerged at the same time. This secured the cut end from exposure to the air. The surface of the water in the tube was prevented from evaporating by a few drops of oil forming a thin layer. The whole is easily

and accurately weighed to the 500th part of a gramme. The tube with the shoot or leaf thus prepared was enclosed in a box covered above with the sheet of coloured glass.

Although experimenters have so generally employed cut shoots and leaves, I soon found, on making my calculations from data accumulated from the weights, that although some may appear quite fresh to the eye for three or even more days after the commencement of the experiment, yet the vitality of the shoot or leaf had, nevertheless, been becoming enfeebled all the while, and the amount of water transpired steadily decreased day by day irrespective of the characters of the coloured glasses used; so that finally the relative amount of loss in successive days became untrustworthy.

To ascertain the differences in the amount of water transpired under the influence of different rays of the spectrum, prolonged and repeated exposure of the same specimen to the same kind of light is necessary. The reason for this is obvious; for there are (as stated above) so many disturbing influences which may materially affect the results, that unless they be reduced to a minimum, the effect due to colour alone cannot be even approximately ascertained.

If, however, the experiments be carried on under conditions which will reduce the above disturbing elements to a minimum, then the differences due to the colour of the light transmitted will be the most powerful agent in the process of transpiration; and it is only by taking the mean of many experiments that the above influences can be virtually eliminated.

In attempting to do this with cut specimens, none will be found to last long enough unaffected by the lesion to give very trustworthy results. Hence, although such experiments may tend to corroborate those obtained by more perfect methods, yet I do not think it worth while to enumerate more than a brief series of my own, numerous as they have been, as by themselves they would not furnish a sufficiently accurate basis for induction. They may have their use, however, in showing the somewhat negative, or at least uncertain, results which are generally only obtainable from cut specimens.

The next method I adopted was to take small plants with their roots carefully lifted and freed from soil, and to insert them in test-tubes as before. The results were even more unsatisfactory than with cut specimens, for, excepting Radish (the thick root of

which presumably acts as a reservoir of water), the others, having fibrous roots, gave a steadily decreasing loss day by day, showing no maximum or minimum, except in some cases with clear glass on the sixth day, on which the loss was greater than in the preceding.

One suspects, therefore, that roots naturally grown in soil and transferred to water, cannot carry on their function of absorption in a normal manner beyond a very short period of time. My experience seems to corroborate that of Sachs*, quoted by Duchartre† :—" Ce physiologiste a reconnu que les racines qui se sont produites dans la terre ne peuvent végéter ensuite dans l'eau et que réciproquement celles qui ont pris naissance dans l'eau ne peuvent remplir leurs fonctions dans la terre."

The plan I finally adopted was to grow small plants in miniature pots, 2 inches high and nearly 2 inches in diameter. These can be entirely wrapped up in gutta-percha sheeting, which is carefully bound round the stem of the plant with cotton-wool within and around the stem. This effectually prevents any evaporation from the surface of the earth or pot; and all loss of weight is due to the transpiration from the exposed surface of the plant alone‡.

My experiments were made upon Lettuce, Box, *Echeveria*, small seedling Palms, Ferns, Cactus, and many other kinds of shrubs and herbs; having selected them with very various degrees of density in the epidermis, as well as of different families. The results would seem to entirely corroborate the conclusion of Wiesner, that transpiration is mainly effected by the Red, Blue, and Violet rays; while the (optically) brightest rays of yellow and green are generally less able to effect it, *even if they do not hinder it*. I emphasize this sentence, as there appear to me to be grounds for coming to such a conclusion, as will be seen hereafter.

Description of Experiments.—The experiments were all conducted in a room with one window of N. aspect, into which the sun never entered, except just before setting in midsummer, and then only at one corner of the window. The light was, moreover, partially obscured by foliage of high trees in front of it. The window was never opened, and the temperature varied but very little, the maxima ranging from 61° to 66° F. by day, and the minima from

* Bot. Zeit. 1860, p. 113.

† Éléments de Botanique, 2me éd. 1877, p. 289.

‡ Even in this case we meet with a difficulty, in that after several days the absence of air to the roots is liable to cause small and delicate plants to suffer; so that other precautions must be taken with them, in not allowing the soil to be too wet, and in admitting air from time to time.

57° to 61° by night, so that the effects from this cause may be practically put on one side. Similarly the humidity of the air of the room may be neglected. They were all carried on between May and September in the years 1880–85.

The most disturbing element was evidently the variable amount of light or its intensity; and this is unfortunately, as remarked, just the very thing which cannot be estimated*. I have already quoted Wiesner's experiment, which showed how even a passing cloud may affect the amount of vapour transpired, so that to deduce mean results of any value, a very considerable number of comparative experiments must be made. The following examples may be taken in illustration. The specimens employed were cut shoots in test-tubes as described; and it will be seen that while in the case of the *Euonymus japonicus* and *Pelargonium* the blue light gives a minimum, yet this result does not agree with those resulting from more prolonged experiments with growing plants, as will be seen further on, where the mean loss of several days' duration is almost invariably greater under blue than yellow glass; and very rarely did the yellow glass permit of a greater loss than the red. Again, clear glass usually gives another maximum, as in the case of the Portugal Laurel and Fern; but with the *Euonymus* it gave the same loss per hour as the green glass, under which it is usually feeble.

1. Experiments during Short Periods with Detached Leaves.

Portugal Laurel.

Duration.	Colour.	Total loss.	Loss per hour.	Mean temp. F.†
		gramme.	gramme.	°
9.53 A.M. to 11.34 A.M....	R.	·995	·59	59·5
11.34 to 2.7 P.M....	Y.	·305	·12	60·0
2.7 P.M. to 4.26 ...	G.	·335	·14	60·0
4.26 to 5.45 ...	B.	·190	·14	61·0
5.45 to 6.35 ...	V.	·120	·14	60·0
6.35 to 7.35 ...	Cl.	·170	·17	59·0

* I attended a meeting this spring (1885) at which this subject was discussed by the leading meteorologists of the day. The general conclusion arrived at appeared to be that no instrument at present invented can give more than roughly approximate results of the quantity of direct sunshine recorded; none, the actual amount of sunlight, and that some instruments in use give very erroneous results indeed.

† The mean temp. is obtained from the max. and min. of the period.

Asplenium, sp.

Duration.	Colour.	Total loss.	Loss per hour.	Mean temp. F.
		gramme.	gramme.	°
10.15 A.M. to 11.46 A.M....	R.	·185	·120	59·5
11.46 to 2.12 P.M....	Y.	·215	·088	60·0
2.12 P.M. to 4.37 ...	G.	·190	·078	60·0
4.37 to 5.55 ...	B.	·105	·092	61·0
5.55 to 6.45 ...	V.	·070	·084	60·0
6.45 to 7.40 ..	Cl.	·090	·098	59·0

Euonymus japonicus.

Duration.	Colour.	Total loss.	Loss per hour.	Mean temp. F.
		gramme.	gramme.	°
10.2 A.M. to 11.40 A.M....	R.	·060	·037	59·5
11.40 to 2.10 P.M...	Y.	·045	·018	60·0
2.10 P.M. to 4.30 ...	G.	·035	·015	60·0
4.30 to 5.50 ...	B.	·010	·007	61·0
5.50 to 6.38 ...	V.	·015	·018	60·0
6.38 to 7.38 ...	Cl.	·015	·015	59·0

2. Examples of Experiments with Detached Leaves lasting 24 hours under each glass. Range of temp. 55°–57° F.

Aucuba japonica.

Colour.	Total loss.
R.	·405
Y.	·285
G.	·245
B.	·315
V.	·325
Cl.	·334

Adiantum, sp.

Colour.	Total loss.
R.	·400
Y.	·260
G.	·475
B.	·265
V.	·300
Cl.	·170

Coleus (red-leaved).

Colour.	Total loss.
R.	·550
Y.	·215
G.	·120
B.	·180
V.	·335
Cl.	·260

Pelargonium.

Colour.	Total loss.
R.	·660
Y.	·265
G.	·235
B.	·205
V.	·295
Cl.	·280

3. Experiments with Rooted Plants in Water for 24 hours under each glass. Range of temp. 57°–61° F.

Euphorbia.

Colour.	Total loss.
R.	1·47
Y.	1·23
G.	1·23
B.	·82
V.	·75
Cl.	·72

Wallflower.

Colour.	Total loss.
R.	1·91
Y.	1·34
G.	1·34
B.	·91
V.	·75
Cl.	·81

Grass.

Colour.	Total loss.
R.	1·93
Y.	1·91
G.	1·43
B.	1·18
V.	1·16
Cl.	1·36

Radish.

Colour.	Total loss.
R.	1·13
Y.	1·11
G.	1·03
B.	·86
V.	·91
Cl.	·99

In these examples, excepting the last one, the loss steadily decreased from R. to V., showing no maxima, as already stated. The last one alone shows an increase under violet as well as clear glass, which may perhaps be accounted for by the succulent nature of the root, as already suggested.

4. *Experiments for Longer Periods.*—I selected six young Lettuce plants on May 15th and May 23rd, 1883, respectively, from a bed and transferred them to miniature pots. They were allowed to become well established, and then the pots were completely invested in gutta-percha sheeting as described. Each plant was placed under the coloured glasses in succession for 24 hours, with the following results (loss in grammes):—

Mean Temperature 64°.

No. of Pot.	R.	Y.	G.	B.	V.	Cl.
I.	1·09	1·16	1·06	1·29	1·47	1·29
II.	·61	·07	·55	·72	·95	·61
III.	1·05	1·16	1·22	1·25	2·16	·63
IV.	1·43	1·05	1·16	1·16	1·92	1·72
V.	1·11	1·09	·89	1·02	1·48	1·13
VI.	1·39	1·62	1·48	1·21	1·75	1·50
Totals...	6·68	6·15	6·36	6·65	9·73	6·88

The temperature during the six days occupied with this experiment varied only eight degrees, from 56° to 64° F.; and to show how little this affects the results, the temperature for pot I. under

red glass ranged from 59° to 64°; while that for the same plant under yellow glass was from 59° to 62°; and yet in this instance the yellow glass gave a rather higher loss than the red. Again, for No. II., the temperature for red glass varies from 59° to 60°, that for yellow from 59° to 64°, showing that in both cases the temperature was *lower*, when the loss was comparatively *greater*, contrary to what would be expected, since it is known that an elevation of temperature is one of the causes of increasing the loss of moisture. The differences, therefore, must be put down to the unascertainable variations in the amount of sunlight.

Hence will be seen the importance of a protracted series of experiments; and the results given under the line of "Totals" will undoubtedly be a much nearer approximation to the truth.

These give one maximum for the red, and another for blue and violet, together; while yellow and green together furnish a decided maximum.

An independent maximum is also supplied by clear glass. Comparing this with the effects of the yellow glass, which also transmits red light, it seems that so far from the optically brightest rays being a chief cause of transpiration, the yellow, and those rays on the more-refrangible side of it, where the chlorophyll absorption-bands, viz. Nos. II., III., and IV., are feeblest, *must have actually a retarding influence upon the effect of red and violet lights*, which *per se* are most powerful.

Lettuces (second series).

No.	R.	Y.	G.	B.	V.	Cl.
I.......	1·13	1·05	1·04	1·15	1·42	1·54
II.......	·81	·54	1·02	·33	1·08	·68
III.......	1·22	1·20	1·12	1·50	1·55	1·35
IV.......	1·89	1·10	1·87	1·54	1·59	1·39
V.......	·92	1·35	·97	·73	1·20	1·33
VI.......	1·93	1·40	1·29	1·50	2·41	1·58
Totals...	7·90	6·64	7·31	6·75	9·25	7·87

The temperature for the six days ranged from 57° to 66°.

As in the preceding series, one maximum occurs under the red, another under the violet or most-refrangible end, while yellow is again a minimum. Green gives a rather higher result than before. Combining the two series, the mean of the two totals is as follows:—

R.	Y.	G.	B.	V.	Cl.
7·29	6·39	6·98	6·70	9·49	7·37

This result clearly shows the preponderating effects of the red and violet ends of the spectrum; and they are of course just where the strongest chlorophyllian absorption-bands occur.

Clear glass gives a decided maximum, though in many cases the loss is less than under violet alone; hence I would repeat, and I believe the observation has not been made before, that yellow light has a decidedly retarding influence upon the amount of water exhaled by red and violet lights.

Though such is the case with the rapidly transpiring herbaceous leaves of the Lettuce, it appears to be somewhat different with Palms and Box, as the following series will show; for out of ten observations on Palms on seven occasions, the loss under clear glass was greater than under violet, and on six occasions greater than under red. With Lettuces the loss under clear glass was on as many occasions greater than that under the red glass as the reverse. In the case of the Box, however, the loss under red and violet was always greater than under clear glass. But the preponderance of red over yellow is not so pronounced as with Lettuces.

Lettuces (third series).

Range of Temperature 53°–58°.

No.	R.	Y.	G.	B.	V.	Cl.
I.	·70	·62	·43	·44	1·07	·46
II.	·30	·27	·81	·49	·55	·62
III.	·80	·55	·77	·59	·89	·62
IV.	·58	1·10 *	1·45 *	·72	1·83	·70
V.	·29	·43	·72	·30	·81	·59
VI.	1·44	1·41	1·24	1·76	·97	2·13
Total ...	4·11	3·28	3·97	4·30	6·12	5·12
Mean ...	·68	·65	·79	·71	1·02	·85

The numbers with asterisks are omitted in calculating the means, as the foliage had become partly flaccid, and they are undoubtedly too high. It was on these two occasions that I first realized the important difference between evaporation from dying or dead matter and transpiration from an actively growing or living plant. Subsequent experiments have proved that evaporation proceeds much more rapidly when life is enfeebled or extinct than when the plant is alive. In the latter case this purely physical process is to some extent kept in check, while transpiration, so to say, takes its place.

Taking the mean of the three series, the results are as follows:—

R.	Y.	G.	B.	V.	Cl.
5·09	4·46	4·82	4·70	6·66	5·20

These give decided maxima under red, violet, and clear glass, with minima under the central portion of the spectrum.

Box.

Six small Box plants, well rooted, were grown in pots as described, with the following results after twenty-four hours' exposure in each case.

Range of temperature 57°–65°.

No.	R.	Y.	G.	B.	V.	Cl.
I.......	·75	·65	·76	·81	1·00	·74
II.......	1·37	1·37	1·38	1·23	1·52	1·14
III.......	1·30	·88	1·21	1·04	1·48	1·17
IV.......	1·71	1·96	2·63	2·47	2·82	1·43
V.......	3·48	3·64	3·72	3·54	3·15	2·40
VI.......	2·58	2·91	2·33	2·83	2·67	2·35
Total ...	11·19	11·41	12·03	11·92	12·64	9·23
Mean ...	1·36	1·90	2·00	1·98	2·10	1·54

In this, as in the following case of Palms, the differences are not so pronounced; but violet glass still shows a maximum.

Palms.

Three small Palms of undetermined genera and species were grown and protected from evaporation in the same manner as in the preceding experiments, and subjected to each of the glasses for twenty-four hours successively. The losses in weight were as follows:—

Temperature varied from 60° to 68°.

No. I.

	R.	Y.	G.	B.	V.	Cl.
	1·02	1·09	·84	·73	·95	1·11
	·70	·97	·90	·96	·93	1·13
	1·22	·87	·85	·85	·99	·79
	·73	·88	·62	·58	·71	·69
	·56	·63	·53	·69	·66	·81
Totals.........	4·23	4·44	3·74	3·81	4·24	4·53

No. II.

	R.	Y.	G.	B.	V.	Cl.
	·93 1·74 ·61 ·47 ·92	·93 ·92 ·50 ·54 ·35	1·10 ·76 ·87 ·48 ·56	·80 ·88 ·69 ·34 1·01	·79 ·74 ·72 ·71 ·63	1·45 1·05 ·89 ·77 ·32
Totals.........	4·67	3·24	3·77	3·72	3·59	4·48

No. III.

	R.	Y.	G.	B.	V.	Cl.
	·60 ·64 ·47 ·34 ·54	·53 ·69 ·46 ·36 ·44	·60 ·47 ·63 ·41 ·32	·70 ·79 ·77 ·41 ·48	·50 ·70 ·39 ·37 ·43	·97 ·58 ·73 ·45 ·62
Totals.........	2·59	2·48	2·43	3·15	2·39	3·35

Mean of the three totals :—

3·83	3·38	3·31	3·56	3·41	4·12

A result much the same as in the case of the Lettuces. Red, blue, and violet rays give manifest maxima; yellow and green minima; while clear yields the highest maximum of all.

These experiments with the Palms show the necessity of making a prolonged series with the same plants; for the totals for No. I. taken alone would lead us to suppose that the yellow glass was most favourable of all the colours; but variations of sunlight, coupled with slight variations of temperature, may account for it. Thus, when the yellow glass gave a loss of ·97 gramme, and red only ·70, the temperature ranged from 63° to 66° with the former, and only from 61° to 64° with the latter on June 28, 1883. Again, yellow gave a loss of ·88 gr. on July 16th, with a temperature ranging from 57° to 62°; but on the day before the red glass gave a loss of ·75, while the temperature ranged from 59° to 64°; hence, in all probability, it was a duller day.

These irregularities, however, become eliminated when so large a series of observations as eighteen for each colour are taken; for

I consider the proof of their elimination to reside in the general agreement of their results with those of other plants treated in the same way.

Cactus.

A small specimen of a cylindrical Cactus, growing in a pot and protected as described, gave the following results :—

	R.	Y.	G.	B.	V.	Cl.	Range of temp.
	·12	·11	·07	·08	·05	·12	44°—52°
	·01	·15	·04	·16	·05	·10	40°—53°
	·18	·27	.10	·17	·12	·14	54°—63°
	·13	·25	(?)	·07	·23	·03	54°—61°
	·22	·14	·21	·03	·26	·15	55°—64°
	·18	·17	·15	·21	·12	·07	54°—60°
Total	·84	·99	·57	·72	·83	·61	44°—64°
Mean	·13	·16	·11	·12	·14	·10	54°

In this case yellow glass gives a higher loss than red; and as this also occurred with Box, and with one of the Palm series, but with neither of the Lettuce series, one is led to imagine that the character of the epidermis may be an important factor, and alter the effect of the light.

Fern.

A small Fern, apparently a species of *Asplenium*, was experimented with, simultaneously with others. It gave the following results :—

	R.	Y.	G.	B.	V.	Cl.
	·78	·77	·86	·72	·77	·83
	·87	·66	·83	·60	·79	·50
	·76	·86	·62	·65	·67	·75
	1·54	·87	·84	1·15	1·03	1·33
Total	3·95	2·96	3·15	3·12	3·26	3·41
Mean	·99	·74	·79	·78	·81	·85

This result obviously agrees with the preceding.

Echeveria metallica.

Two plants were treated as the others, and were placed under each of the coloured glasses for three days. The mean of the total losses under each colour respectively was as follows :—

R.	Y.	G.	B.	V.	Cl.
·261	·243	·264	·265	·263	·274

In this case the transpiration, as is well known, is slight, in consequence of the thick cuticle. I have therefore taken it to three places of decimals; but here, again, yellow gives a decided minimum, and clear glass the highest maximum, the other maxima being but slightly different from each other.

Conclusion.—The above experiments, selected from a large series, seem to me to abundantly prove that Wiesner's results are correct; and while recognizing the fact that obscure heat-rays cause a certain amount of the loss of water by evaporation, that transpiration *per se* (theoretically distinct from the purely physical process of evaporation, which takes place from all moist surfaces and bodies, dead or alive) is especially, if not solely, referable to those particular bands of light which are absorbed by chlorophyll, and that such light, being arrested, is converted into heat, which then raises the temperature within the tissues and causes the loss of water. The only additional fact which I have here advanced, somewhat tentatively, is that yellow light has a *retarding influence* upon transpiration, for the reasons given above. That "life" has a retarding influence upon evaporation as distinct from transpiration, I think my experiments (which I hope to continue hereafter) have distinctly proved.

On the Relation between the "Bloom" on Leaves and the Distribution of the Stomata. By FRANCIS DARWIN, F.R.S., F.L.S.

[Read 4th February, 1886.]

SACHS* has pointed out that there is a connection between the distribution of stomata on leaves and their protection from wet by the wax-like coating commonly known as "bloom."

He says:—"It is especially the surfaces of leaves that are well provided with stomata which seem to be protected against the adherence of water. The leaves of water-plants such as the Nymphæaceæ, *Polygonum amphibium, Hydrocharis*, &c., are thoroughly wetted on their lower surfaces, which have no stomata; but water runs off in round drops from the upper surface, where the stomata occur. The meaning of this fact in the economy of the plant is evident; the mouths of the stomata would be closed by prolonged contact with water, and would thus prevent the rapid ingress and egress of gas."†

In the year 1878 my father was engaged in studying the bloom on leaves, and it fell to my share to follow up the suggestion of Sachs—that one function of bloom is to be found in the protection of the stomata from wet. The mere fact that stomata close when the leaf is wetted might lead us to expect that water interferes with their function, even if we had no theoretical reasons for believing so. Barthélemy (as quoted in the Botan. Centralblatt, vol. xix.) has recorded a fact demonstrating the closure of stomata by water. The leaves of *Nelumbium* give out bubbles of gas when immersed in water and exposed to sunshine, but the production of bubbles ceases if the "bloom" is removed so that water comes into contact with the stomata. The conclusion that the closure of the stomata is due to contact with water must, however, be cautiously received, for it seems probable, as Garreau‡ states, that the act of washing

* 'Physiologie Végétale' (French translation), 1868, p. 178.

† In Lundström's interesting paper, "Die Anpassungen der Pflanzen an Regen und Thau" (Nova Acta Reg. Soc. Sci. Upsal. 1884), the author points out that in *Trifolium repens* the *under* surface of the leaflets is wetted by rain, while the upper bloom-protected surface remains dry. He connects this fact with the occurrence of stomata on the upper surface.

‡ Ann. Sci. Nat. 1850.

off the bloom stops up the stomata. There are certain facts which go to show that stomata tend to be developed in parts protected from rain. The well-known fact that in a large number of leaves the stomata are exclusively on the lower surface, where they are not so likely to be wetted, is in accordance with this statement. In vertical leaves, as is well known, the stomata are equally distributed on the two surfaces*, and in most such leaves the surfaces would be equally wetted. An interesting confirmation of this view may be found in the fact mentioned by Haberlandt † that lenticels are "fairly equally distributed all round vertical branches, while on horizontal branches they are much more numerous on the lower than on the upper side. We might expect that the function of lenticels would be interfered with by wetting in the same way as applies to stomata, and it is therefore of interest to find that (at least in young branches, according to Haberlandt) they tend to be developed chiefly on the underside, where they are more or less protected. In young leaves, which are often more nearly vertical than the adult leaves of the same species, we may perhaps believe that stomata are protected by not being open at first, but whether the opening of the stomata corresponds with the assumption of the horizontal position I cannot say. Von Höhnel has shown that the cuticular transpiration of young leaves is very large, so that even with closed stomata they may transpire sufficiently.

The idea that the tendency to accumulation of stomata on the under surface of leaves is an arrangement by which they are protected against rain, is in accordance with Hohnfeldt's observations ‡. He found that in underground leaves the stomata show no marked tendency to accumulate on the under surface; indeed the contrary is often the case. This is precisely what might be expected on the theory that they are developed on the under surface of aerial leaves as a protective against rain, &c., since the underground leaves are of course not exposed to such dangers. Hohnfeldt quotes Caruel's remarks on

* In the nearly vertical leaves of *Lactuca Scariola* I found the stomata on the morphologically lower side to be the most numerous—exceeding those on the other side in about the proportion of 140 : 100.

† Physiolog. Pflanzenanatomie, p. 317.—Haberlandt gives no explanation of the fact.

‡ As reported in the Botan. Centralblatt, 1880, p. 1161.

Passerina hirsuta: the upper surfaces only of the leaves have stomata, and these surfaces are protected by being pressed closely to the stem or against other leaves.

With regard to the kind of wetting which is prevented by the bloom on leaves, it is probable that it is more effective against rain than against dew, since at least some bloom-protected leaves are easily covered with a coating of dew in very finely divided drops. It is curious to observe the effect of immersion on such a leaf—which may be plunged into water still retaining its coating of dew, and will be found to be perfectly dry on being removed from the water—so that the readiest way of drying such a leaf is to dip it into water. Another fact may perhaps be mentioned as tending, as far as it goes, to confirm the view here advocated—namely, that bloom is frequently absent from the projecting nervatures, though present on other parts of leaves—the nervatures being the parts of leaves on which stomata are not developed.

Finally, it must be remembered, since bloom certainly has other functions besides the protection of leaves from wetting, that it cannot be expected that every species should show a correspondence in the distribution of bloom and stomata. Lundström's essay, above alluded to, is of interest in this connection He shows that in some species arrangements exist for the collection and distribution and absorption of rain as it falls on the leaves; and here the surfaces are so modified, by secretions &c., that they are wetted with especial ease. This class of cases must no doubt have a bearing on the subject of the present paper. Such cases as those of *Trifolium repens* and *Vaccinium Vitis-idæa*, where the *lower* surface of the leaf is especially wetted by rain, are of much interest.

The case of *Lobelia Erinus* also conveys a caution. Here, according to Lundström, there are small scale-leaves at the base of the flower-stalk which collect the rain on their upper surfaces; yet it is on these surfaces that the stomata exclusively occur. This case is not in reality opposed to my results, since the stomata function as organs of absorption.

The results here obtained were worked out in the year 1878, and it was intended to publish them in a work of my father's to be devoted to the subject of bloom. I shall on another occasion give some account of my father's results, and of some further

work of my own in the same direction. The present paper, with the exception of the introductory remarks, is written entirely from my notes of 1878.

Through the kindness of Sir J. D. Hooker I was enabled to carry out the work in the Jodrell Laboratory in the Royal Gardens at Kew. I was thus enabled to obtain a large supply of fresh material, a necessary condition to the success of my investigation. It is a pleasure to me to express my sincere thanks for the opportunity which he so kindly placed at my disposal. I wish also to express my thanks to Mr. R. Irwin Lynch, now Curator of the Cambridge Botanic Gardens, but who at that time held a post at Kew. Through Mr. Lynch's kind assistance I was able to obtain good specimens of the many species which I required.

I first made a list of species of which the number of stomata on the leaves have been determined, using for this purpose the works of

Czech (Botan. Zeitung, 1865).
Kareltschikoff (Bull. de la Soc. des Naturalistes de Moscou, 1866).
Morren (Bull. de l'Académie R. de Belgique, t. xvi.).
Weiss (Pringsheim's Jahrb. vol. iv.).

This list I gave to Mr. Lynch, asking him to supply me with specimens of species chosen at random from among those in my list; I hoped in this way to get some idea of the number of plants which have bloom-protected leaves. But I was obliged to supplement the list with leaves selected as having bloom, so that no accurate conclusions of this kind can be drawn from my tables. In these cases, as well as in many others, I made use of my own observations on the number of stomata.

Having obtained my specimens, I had merely to note the distribution of bloom on the surface of the leaves. This is not so easy as it might seem, since many leaves occur which are perfectly dry after immersion, and which, nevertheless, have no true bloom. In the following tables the leaves noted as having bloom are such as examination with the naked eye sufficed to classify among "bloom" leaves. Bloom is here used to mean a coating of minute particles of a waxy character which is removable either by warm water (about 40° C.) or in any case by ether. Leaves occur which emerge from water dry on the lower surface, but which have no bloom in the above sense.

Between leaves such as these and those which are completely wetted, a number of gradations occur. We find more or less perfect developments of a certain character of the surface—which may be called greasiness. The water coating the surface shrinks into patches or drops, leaving large areas dry. The leaf, in fact, behaves towards water like certain metallic or grease-coated surfaces. The degree of greasiness varies a good deal, some leaves exhibiting it in great perfection, while others do so only when the leaf is shaken. The stomata of many of this kind of leaf must, no doubt, be protected against wet; but as they graduate into those which are easily wetted, I have placed them (except those mentioned on p. 108) in the class having no bloom. I am inclined to think that immersion in water is not a thoroughly satisfactory test of the leaf's capacity of resisting natural sources of wet, since some of the "greasy" or "metallic" class of leaf seem to be much more completely wetted by rain than by a single immersion in water. This is a further reason for keeping the best protected leaves, those which have a true bloom, in a separate class. Leaves such as *Hydrangea quercifolia* and the Raspberry have their lower surfaces almost perfectly protected against wetting, but this is due to a fine coating of hairs. As such cases do not bear on the function of bloom proper, but only on the general question of the protection of stomata, they are excluded from my tables.

It must be remembered that bloom is in many cases easily injured, and that in old leaves it is sometimes washed off by rain or removed by rubbing against other leaves, &c. It is therefore possible that some leaves noted as having no bloom may show this coating under other circumstances; I can only say that I have been aware of, and tried to avoid, this error.

In dealing with the results I have been obliged to use a few simple symbols. The number of the stomata on a leaf is expressed as a fraction, of which the numerator expresses the number of stomata on the upper surface and the denominator the number on the lower. Thus $\frac{100}{150}$ would mean that the upper stomata are to the lower as 100 to 150. My figures being taken from different sources cannot be taken to represent any absolute number of stomata per square millimetre, but merely the proportion between the stomata on the upper and lower surfaces.

When there are no* stomata on the upper surface the state of things is expressed by $\frac{0}{S}$, the letter S being employed in the denominator to show that the symbol expresses the distribution of the *stomata* and not of the *bloom*, in which latter case the letter B is employed. According to this plan the floating leaves of water-plants would be symbolized by $\frac{S}{0}$:—no stomata on the under surface. Precisely similar symbols are used to express the distribution of bloom:—

$\frac{B}{B}$ = Bloom on the upper as well as on the lower surface.

$\frac{0}{B}$ = Bloom on the lower surface only.

$\frac{B}{0}$ = Bloom on the upper surface only.

$\frac{0}{0}$ = No bloom on either surface.

The leaves examined are divided into four classes according to the distribution of the bloom, and each class is analysed into groups according to the distribution of the stomata.

The leaves forming Class $\frac{0}{0}$ have no bloom on either surface; and those in Group 1 have no stomata on the upper surface.

Class $\frac{0}{0}$.—No bloom on either surface.

Group 1.—Stomata = $\frac{0}{S}$. 75 species.

Acer platanoides.
Aconitum Napellus.
A. lycoctonum.
Actæa spicata.
Ægopodium Podagraria.
Æsculus Hippocastanum.
Amygdalus communis.
A. persica.
Andromeda speciosa.
Anemone japonica.
Araucaria Bidwellii.
Asarum europæum.
Asclepias curassavica.
Begonia hydrocotylifolia.
B. quinquifolia.
Betula alba.
Brexia madagascariensis.
Broussonettia papyrifera.
Buxus sempervirens.
Camellia japonica.

* In leaves usually described as having no stomata on the upper surface, there are often a few scattered ones, especially near the veins.

Carpinus betulus.
Celtis occidentalis.
Cerasus Mahaleb.
C. vulgaris.
Citrus Aurantium.
Clematis Viticella.
Cratægus oxyacantha.
Fagus sylvatica.
Ficus benjamina.
F. cordata.
F. elastica.
Fraxinus excelsior.
Gastonia palmata.
Gentiana cruciata.
Girondia manicata.
Gleditschia triacantha.
Goldfussia glomerata.
Hedera Helix.
Helleborus niger.
Hydrangea hortensis.
H. quercifolia.
Ilex Aquifolium.
Juglans regia.
Kalmia latifolia.
Lilium speciosum.
Maclura aurantiaca.
Mahonia Aquifolium.
Maianthemum bifolium.
Mercurialis perennis.
Morus alba.
Negundo fraxinifolia.
Olea europea.
Philadelphus coronarius.
Piper magnoliæfolium.
Pittosporum Tobira.
Platanus occidentalis.
Pæonia sp.
Pritzelia zebrina.
Prunus domestica.
P. Laurocerasus.
Pyrus communis.
P. Malus.
Rhodea japonica.
Rhododendron hirsutum.
R. ponticum.
Ribes aureum.
Rubia tinctorum.
Salisburia adiantifolia.
Solanum tuberosum.
Syringa vulgaris.
Taxus baccata.
Theophrasta Jussieui.
Trollius europæus.
Vinca major.
Vitis vinifera.

Group 2.—Stomatal formula between $\frac{0}{S}$ and $\frac{1}{2}$; that is to say, one third, or less than one third of all the stomata are on the upper surface. 29 species.

Antirrhinum majus	$\frac{2}{120}$
Apium Petroselinum	$\frac{27}{61}$
Asclepias incarnata	$\frac{67}{191}$
Aster chinensis	$\frac{16}{40}$
Atropa Belladonna	$\frac{55}{227}$
Brassica Rapa	$\frac{21}{61}$
Campanula persicifolia	$\frac{3}{210}$
C. urticæfolia	$\frac{6}{65}$
Capsella Bursa pastoris	$\frac{33}{114}$
Centaurea phrygia	$\frac{23}{78}$
Convolvulus arvensis	$\frac{21}{43}$
Dianthus barbatus	$\frac{12}{47}$
D. deltoides	$\frac{47}{110}$
Galium boreale	$\frac{10}{129}$
Geum urbanum	$\frac{20}{193}$
Gratiola officinalis	$\frac{4}{57}$

Impatiens parviflorum	$\frac{9}{46}$
Levisticum officinale	$\frac{48}{97}$
Menyanthes trifoliata	$\frac{8}{40}$
Orobus vernus	$\frac{1}{38}$
Papaver Rhœas	$\frac{9}{37}$
Phaseolus multiflorus	$\frac{18}{103}$
Plumbago Larpentæ	$\frac{41}{101}$
Populus dilatata	$\frac{55}{270}$
P. nigra	$\frac{54}{313}$
P. pyramidalis	$\frac{11 \cdot 2}{40 \cdot 6}$
Saponaria officinalis	$\frac{14}{74}$
Senecio vulgaris	$\frac{20}{78}$
Tradescantia subaspera	$\frac{7}{28}$

Group 3.—Stomatal formula $\frac{1}{2}$ to $\frac{1}{1}$ (excluding $\frac{1}{2}$, including $\frac{1}{1}$).

The stomata on the upper surface form more than a third, but not more than half, of the whole number of stomata. 30 species.

Amarantus caudatus	$\frac{171}{193}$
Aster pyrenæus	$\frac{35}{88}$
Atraphaxis spinosa	$\frac{112}{157}$
Barbarea vulgaris	$\frac{129}{189}$
Bidens tripartita	$\frac{55}{82}$
Calendula officinalis	$\frac{18}{22}$
Chenopodium Bonus-Henricus	$\frac{47}{69}$
Chrysanthemum Leucanthemum	$\frac{42}{49}$
Convolvulus tricolor	$\frac{20}{39}$
Dianthus Seguierii	$\frac{7 \cdot 4}{9 \cdot 2}$
Helianthus annuus	$\frac{175}{325}$
Isatis tinctoria	$\frac{214}{231}$
Lepidium ruderale	$\frac{16}{16}$
Lychnis Viscaria	$\frac{59}{91}$
Pentstemon barbatus	$\frac{185}{233}$
Plantago lanceolata	$\frac{76}{117}$
P. media	$\frac{64}{105}$
Populus Carolinæ	$\frac{263}{405}$
P. monilifera	$\frac{89}{131}$
Rhipsalis crispata (Succulent.)	$\frac{10}{12}$
Rumex Acetosa	$\frac{16}{28}$
Scabiosa arvensis	$\frac{43}{59}$
Silene inflata	$\frac{33}{60}$
Statice latifolia	$\frac{98}{106}$
Tanacetum vulgare	$\frac{72}{82}$
Valeriana Phu	$\frac{69}{95}$
Viscum album	$\frac{1}{1}$
Yucca aloifolia (Thick and leathery.)	$\frac{7 \cdot 6}{8 \cdot 2}$
Zea Mays	$\frac{94}{158}$
Zinnia elegans	$\frac{31}{55}$

Group 4.—More stomata on the upper surface than on the lower: stomatal formula greater than $\frac{1}{1}$. 9 species.

Acacia decipiens	$\frac{103}{96}$	Vertical.
Achillea Millefolium	$\frac{61}{12}$	
Alisma Plantago	$\frac{135}{100}$	
Araucaria imbricata	$\frac{46}{45}$	
Ranunculus Flammula	$\frac{46}{23}$	Some leaves have bloom above.
Sedum acre	$\frac{6}{4}$	Succulent.
S. album	$\frac{14}{7}$	Succulent.
Sempervivum tectorum	$\frac{107}{60}$	Succulent.
Statice incana	$\frac{75}{60}$	

Among the above 143 plants are some which cannot fairly be compared with the rest, from their different structure. These are :—

	Stomata.
Acacia decipiens	$\frac{103}{96}$
Rhipsalis crispata	$\frac{10}{12}$
Sedum acre	$\frac{6}{4}$
S. album	$\frac{14}{7}$
Sempervivum tectorum	$\frac{3}{4}$
Yucca aloifolia	$\frac{76}{8 \cdot 2}$

Acacia is excluded because of the vertical position of its leaves. The succulents are obviously not comparable with ordinary leaves in the matter of stomata distribution. In a thick fleshy leaf, with relatively few stomata, the few that do exist may be necessarily more evenly distributed than in a thin leaf.

If we divide the species into two sets—(A) in which the stomata on the upper surface are one third or less than one third of the whole number of stomata; (B) where they are more than one third of the whole—we have :—

104 out of 137 species, or 76 per cent., in Class A.
34 out of 137 species, or 24 per cent., in Class B.

These results show clearly that, in leaves with no bloom on either surface, there is a strong tendency towards accumulation of stomata in the lower surface. This is also shown by the fact that, out of the 137 species, 75 (or 55 per cent.) have *no* stomata on the upper surface; that is, in Class $\frac{0}{0}$ (bloom $\frac{0}{0}$), the group $\frac{0}{S}$ are 54 per cent.

Class $\frac{0}{B}$.

Leaves with bloom on the lower surface only.

Here are included a few plants of which the lower surface is of such a character as to come out very dry, though not actually covered with bloom; such as *Cobæa scandens*, *Geranium Robertianum*, *Solanum Dulcamara*, &c. 19 species.

	Stomata.	Remarks.
Abies canadensis	$\frac{0}{8}$	
A. pectinata	$\frac{0}{8}$	
Acer Pseudoplatanus	$\frac{0}{8}$	
Arauja serifera	$\frac{0}{8}$	
Ailanthus glandulosus	$\frac{0}{8}$	
Cassia floribunda	$\frac{0}{8}$	
Cobæa scandens	$\frac{0}{8}$	
Daphne Mezereum	$\frac{0}{8}$	Young leaves have bloom above.
Geranium Robertianum	$\frac{0}{8}$	
Humulus Lupulus	$\frac{0}{8}$	
Pharus latifolius	$\frac{0}{8}$	This twisted grass-leaf has its physically upper side free from stomata. (The physically upper side is morphologically the lower side.)*
Polygonatum multiflorum	$\frac{0}{8}$	
Primula farinosa	$\frac{13}{103}$	Mealy underneath.
Quercus pedunculata	$\frac{0}{8}$	

* M. A. de Candolle has been so good as to call my attention to the fact that Juniper, according to Dutrochet (Mémoire, ii. p. 100), has stomata only on the upper surfaces of the leaves, and the branches hang down so that the upper surface of the leaves is downwards.

	Stomata.	Remarks.
Salix babylonica	$\frac{0}{8}$	
Solanum Dulcamara........................	$\frac{60}{263}$	
Sophora japonica	$\frac{0}{8}$	Young leaves are $\frac{B}{B}$.
Tradescantia virginica	$\frac{1\cdot8}{6\cdot4}$	

The number of species is small; nevertheless it comes out fairly clearly that where the under surface is protected against wet the tendency of the stomata to accumulate on the lower surface is stronger than in the class where bloom is absent altogether.

Fifteen leaves, or 83 per cent., have stomata exclusively on the lower surface; whereas in Class $\frac{0}{0}$ only 55 per cent. were in this condition.

It will be seen that in the three leaves that have any stomata above, their number does not exceed one fourth of the whole number of stomata.

Two leaves may be mentioned in which a coating of hairs on the lower surface serves almost as well as "bloom" to keep the leaf dry during immersion in water, and in which the stomata are chiefly or exclusively on the lower surface. These are the Raspberry and *Hydrangea quercifolia.*

Class $\frac{B}{0}$.

Leaves which have bloom only on the upper surface.

	Stomata.	
Convallaria majalis	$\frac{2\cdot4}{3\cdot1}$	
Lathyrus pratensis	$\frac{38}{41}$	
Primula Auricula	$\frac{8}{0}$	
Ranunculus Flammula......................	$\frac{46}{23}$	Some leaves have no bloom.
Trifolium repens	$\frac{160}{98}$	
Vicia Cracca	$\frac{65}{22}$	
V. sativa	$\frac{100}{32}$	

Seven species*: of which one has all its stomata on the upper

* It was thought fairer to include only one species of *Primula* and of *Trifolium.*

surface, four have at least twice as many stomata above as below, while the remaining two leaves have the formula $\frac{38}{41}$ $\left(\frac{93}{100}\right)$ and $\frac{2\cdot4}{3\cdot1}$ $\left(\frac{77}{100}\right)$.

Class $\frac{B}{B}$.

Leaves with bloom on both surfaces.

Group $\frac{0}{S}$; or those in which the stomata are exclusively on the lower surface. They are 16, or 38 per cent.

Alstrœmeria aurantiaca.
(The stomata are on the physically lower, but morphologically upper side.)
Aquilegia vulgaris.
Berberis sp.
Bomarea Caldasii.
Chelidonium majus.
Corydalis capnoides.
Cytisus Laburnum.
Euphorbia Cyparissias.
Hypericum calycinum.
(Bad bloom above.)
Linaria vulgaris*.
Oxalis sp.
Poinsettia sp.
Poterium Sanguisorba*.
Rhus sp.
Robinia Pseudacacia.
Rosa sp.

Group $\frac{0}{S}$ to $\frac{1}{1}$.

The next group comprises those in which there are stomata on the upper surface, but in which they never equal those on the lower surface in number. They are 14 in number, or 33 per cent. of the whole Class $\frac{B}{B}$.

Brassica oleracea	$\frac{219}{301}$
Caladium sp.	$\frac{6}{10}$
Chlora perfoliata	$\frac{1\cdot4}{3\cdot1}$
Crambe maritima	$\frac{12}{16}$
Erythrina cristata	$\frac{0\cdot7}{16}$
Glaucium sp.	$\frac{5\cdot5}{8}$
Mimosa pudica	$\frac{138}{302}$
Pelargonium glaucum	$\frac{8\cdot2}{8\cdot4}$
Ruta graveolens	$\frac{1}{6}$
Sonchus oleraceus	$\frac{17}{80}$
Thalia dealbata	$\frac{6}{18}$
Trifolium pratense	$\frac{95}{97}$ or $\frac{565}{913}$
Tritonia sp.	$\frac{4\cdot7}{5\cdot1}$
Tropæolum (about)	$\frac{15}{30}$

Lastly, there is the Group $\frac{1}{1}$ to $\frac{1+x}{1}$, or those in which the

* These species are placed in Group $\frac{0}{S}$, as the stomata on the lower surface are so much more numerous than those on the upper.

stomata on the upper surface are equal to or more in number than the lower stomata. They are 12, or 29 per cent.

Artemisia Dracunculus	$\frac{42}{41}$	Lotus corniculatus..................	$\frac{68}{49}$
Crinum capense	$\frac{4{\cdot}5}{4{\cdot}5}$	Lathyrus sylvestris	$\frac{79}{53}$
Desmodium gyrans ...... (about)	$\frac{15}{15}$	Medicago lupulina.................	$\frac{118}{100}$
Dianthus sp.	$\frac{7{\cdot}8}{6{\cdot}6}$	Melilotus officinalis	$\frac{83}{61}$
Gypsophila perfoliata	$\frac{103}{98}$	Nicotiana glauca	$\frac{10}{9{\cdot}6}$
Linum flavum.........................	$\frac{5{\cdot}8}{5{\cdot}4}$	Triticum sativum	$\frac{121}{86}$

The Class $\frac{B}{B}$ is thus divided into—

$\frac{0}{S}$	38 per cent.,
$\frac{0}{S}$ to $\frac{1}{1}$	33 „
$\frac{1}{1}$ and over.........	29 „

or they may be arranged thus :—

Those in which upper stomata are fewer than lower 71 per cent.
Those in which upper stomata are equal to or *more numerous* than the lower stomata.................... 29 „

It is well known that succulent plants tend to be covered with bloom. The following plants are excluded from comparison in the matter of stomata :—

Aloe arborescens..............................	$\frac{20}{29}$
Beschorneria Tornellii	$\frac{5{\cdot}5}{6{\cdot}2}$
Calanthe crenata	$\frac{3{\cdot}9}{4{\cdot}3}$
Cotyledon bracteosum	$\frac{2{\cdot}3}{1{\cdot}3}$

Nelumbium speciosum, with stomata only above, and *Marsilea*, with more above than below, are also excluded, having the leaves of a water-plant. It is obvious that if these leaves were included in the above groups, they would favour my conclusions unfairly.

The three following tables give the results of the analysis of the above 204 species :—

	Bloom $=\frac{0}{0}$.	Bloom $=\frac{0}{B}$.	Bloom $=\frac{B}{0}$.	Bloom $=\frac{B}{B}$.
1st Comparison.				
No stomata above	55 per cent.	83 per cent.	0 per cent.	38 per cent.
With stomata above	45 ,,	17 ,,	100 ,,	62 ,,
2nd Comparison.				
Upper stomata equal to or more numerous than lower	5 per cent.	0 per cent.	71 per cent.	29 per cent.
Upper stomata *less* frequent than the lower	95 ,,	100 ,,	29 ,,	71 ,,
3rd Comparison.				
Stomatal formula ½ or less	76 per cent.	100 per cent.	0 per cent.	52 per cent.
Formula greater than ½	24 ,,	0 ,,	100 ,,	48 ,,

Remarks on the Comparisons.

Comparing Class $\frac{0}{0}$ with Class $\frac{0}{B}$, we see that where, as in $\frac{0}{B}$, the stomata on the under side of the leaf have the double protection of position and bloom, the percentage of leaves with stomata exclusively on the lower surface is decidedly greater—83 per cent. compared with 55 per cent.

Comparing Class $\frac{B}{B}$ with Class $\frac{0}{0}$, we find the number of leaves having stomata above to be 62 per cent., instead of 45 per cent. That is, more leaves have *some* stomata above when the upper surface is protected by bloom. But it is remarkable that so many (38 per cent.) of Class $\frac{B}{B}$ should have all their stomata below*. This may, perhaps, be explained by the fact that bloom is in some cases removed by rain, rubbing of other leaves, &c.; so that, even where there is bloom above, the lower surface remains the safest position for the stomata. Nevertheless, we see that in $\frac{B}{B}$ there are more species with some stomata on the upper surface than without any on that surface; whereas in Classes $\frac{0}{0}$ and $\frac{0}{B}$ the reverse is the case.

* These leaves seem, on the whole, to be thin delicate leaves; so that one might imagine that stomata on one surface would suffice, and if so, the under surface would, as suggested, be the best place.

If we look at the Second Comparison, and compare again Class $\frac{B}{B}$ with $\frac{0}{0}$ or $\frac{0}{B}$, we see the influence of bloom on the upper surface determining the distribution of the stomata; for 29 per cent. in $\frac{B}{B}$ have the upper stomata equal in number to, or more numerous than, the lower stomata, as compared with 5 per cent. in $\frac{0}{0}$, or 0 per cent. in $\frac{0}{B}$.

To put it in another way. In Class $\frac{0}{0}$ 45 per cent. have some stomata on the upper surface; but only one ninth of these have the number of upper stomata equal to or greater than the number of lower stomata. In Class $\frac{B}{B}$ 62 per cent. have some stomata above, and nearly half of these have the upper stomata equal in number to, or greater than, the number of the lower ones.

Looking at the third Comparison, and comparing Class $\frac{0}{0}$ with Class $\frac{0}{B}$, we see the same accumulation of stomata on the lower surface, especially when this surface is bloom-protected. Comparing Class $\frac{0}{B}$ with Class $\frac{B}{B}$, we see that this tendency disappears when bloom appears on the upper surface. Lastly, in $\frac{B}{0}$ we see accumulation of stomata on the *upper* surface when this is the *only* surface which is bloom-protected.

The number of species in Class $\frac{B}{0}$ is too few to draw any trustworthy conclusions from. The great tendency to accumulation of stomata on the upper surface is remarkable, especially when this fact is taken in connection with what we know of Class $\frac{B}{B}$, where the upper surface is likewise bloom-protected, but where the tendency to accumulation on the upper surface is much smaller. It is possible that the distribution of stomata is determined in this class $\frac{B}{0}$ by some other circumstances, and that the development of bloom on the upper surface alone has followed as protection to the pre-existing stomata; whereas, under other circumstances, we might imagine bloom to be developed for some other use, and then the distribution of stomata to be altered

accordingly. In whatever way we look at the question, the contrast between Class $\frac{0}{B}$ and Class $\frac{B}{0}$ in the distribution of stomata is certainly striking.

Having been interested by the distribution of stomata in the Auricula, I thought it worth while to investigate a few other species of the genus *Primula*.

	Stomata.	
Primula cortusoides	$\frac{0}{8}$	Or very rare on upper surface. | Imperfect "greasiness" on both surfaces.
P. denticulata	$\frac{3}{13}$	Young leaves mealy on both sides; older ones mealy beneath.
P. purpurea?......................	$\frac{0}{8}$	"Greasy" above; good mealiness below.
P. luteola	$\frac{1\cdot8}{7\cdot3}$	Good "greasiness" on both surfaces.
P. farinosa	$\frac{1\cdot3}{10\cdot3}$	Lower side mealy.
P. sikkimensis	$\frac{1}{17}$	No mealiness on either side.
P. capitata	$\frac{0\cdot}{8}$	Perfect mealiness on the under side; there appear to be traces of meal on the upper.
P. marginata *	$\frac{11\cdot5}{0\cdot7}$	Meal on both surfaces, but better on upper surface.
P. integrifolia *..................	$\frac{8}{0}$	Imperfect mealiness on upper side only.
P. Auricula *	$\frac{8}{0}$	Meal on upper side only.

The meal or bloom on some Primulas is so easily washed off or injured that it is difficult to make certain of the distribution of the mealiness on plants growing in the open air. Nevertheless, I think the results are of some little interest:—(i) Where there is no mealiness, or where the lower surface is so protected, there is a tendency towards accumulation on the lower surface. When, as in the species printed in italics,* the meal is exclusively above or better developed above, we have the stomata exclusively or chiefly above.

The genus *Trifolium* appeared to be interesting in the matter of bloom; I therefore examined the species accessible to me. The genus (as far as I have examined the species) may be divided into two groups:—

(i) $\frac{B}{B}$. Those which have bloom on both surfaces.

(ii) $\frac{B}{0}$. Those which have bloom only above.

Group i. $\frac{B}{B}$.

Trifolium.

	Stomata.	Taking the stomata on the lower surface=100.
T. Aucheri	$\frac{0}{8}$	$\frac{0}{100}$
T. elegans	$\frac{77}{72}$	$\frac{107}{100}$
T. Lupinaster	$\frac{171}{162}$	$\frac{106}{100}$
T. medium	$\frac{0}{8}$	$\frac{0}{100}$
T. minus	$\frac{35}{32}$	$\frac{109}{100}$
T. pannonicum	$\frac{86}{90}$	$\frac{96}{100}$
T. pratense	$\frac{95}{97}$	$\frac{98}{100}$
T. striatum	$\frac{7}{5}$	$\frac{140}{100}$

Two species have all the stomata below. Omitting these, the average stomatal formula is $\frac{109}{100}$.

Group ii. $\frac{B}{0}$.

	Stomata.	Taking the stomata on the lower surface=100.
T. alpestre	$\frac{8}{0}$	$\frac{8}{0}$
T. cæspitosum	$\frac{72}{35}$	$\frac{206}{100}$
T. fragiferum	$\frac{100}{56}$	$\frac{180}{100}$
T. montanum	$\frac{68}{28}$	$\frac{243}{100}$
T. repens	$\frac{160}{98}$	$\frac{163}{100}$
T. uniflorum	$\frac{86}{25}$	$\frac{344}{100}$

One species (*alpestre*) has all its stomata on the upper surface—the reverse of what holds good in Group i. $\frac{B}{B}$, where two species have all their stomata below. Omitting *T. alpestre*, the average is $\frac{227}{100}$.

Thus, when the bloom is on the upper surface only, the average number of stomata on the upper surface (as compared with the lower) is twice as great as in those cases where both surfaces are covered with bloom.

Expressed in symbols:

Trifolium.

Group $\frac{B}{B}$. Group $\frac{B}{0}$.

Stomata $= \frac{109}{100}$. Stomata $= \frac{227}{100}$.

This confirms my former result, viz. that when bloom is developed on the upper surface only, there is a strong tendency to accumulation of stomata on that surface.

Finally, it may be pointed out that the genus *Trifolium* confirms the generalization above made, that when bloom is on both surfaces a large proportion of the stomata appear on the upper surface; although some cases occur in which the stomata occur *exclusively* on the lower surface.

On Dr. Fox's Collection of Orchids from Madagascar, along with some obtained by the Rev. R. Baron, F.L.S., from the same island. By Henry N. Ridley, M.A., F.L.S., Assistant Botanical Department, British Museum.

[Read 17th December, 1885.]

I have to thank the authorities at Kew for placing in my hands for description a collection of Orchids recently made by Dr. Fox in the neighbourhood of Imerina. There were in the collection about 50 numbers and almost as many species, the larger number of which were plants previously obtained by one or other of the botanists who have recently been exploring almost the identical locality. There is, however, on the whole, a very large proportion of novelties, and of these several are peculiarly interesting. The collection adds three new genera to the flora, viz. *Arnottia*, a Mauritian genus of perhaps two species, which it was to have been expected would occur also in Madagascar; the very curious genus *Brownleea*, hitherto only known from Southern Africa, where it is represented by 3 or 4 species; and *Holothrix*, an East- and South-African genus. The Madagascar species is a very remarkable one, differing at first sight from the rest of the genus in many striking particulars. Another interesting novelty is *Satyrium gigas*, probably much the largest species of the genus known.

It is clear from this collection that much yet remains to be done in the island, even in the best-worked localities, and indeed there are still several species known only from Thouars's collections, that are not represented in the herbaria of this country.

I have incorporated also with the account of these plants some notes and descriptions of other new and interesting species recently received from Mr. Baron in Central Madagascar.

BULBOPHYLLUM APPROXIMATUM, n. sp.—Rhizoma validum breve, pseudobulbis conicis monophyllis uncialibus seriatim approximatis; folia elliptica spathulata obtusa 2 uncias longa, $\frac{3}{4}$ lata; scapi nutantes 5-unciales; racemus laxiusculus multiflorus; flores iis *B. Baroni*, Ridl., majores; bracteæ ovatæ cucullatæ quam ovarium longiores, $\frac{1}{8}$ unciæ longæ; sepala ovata lanceolata omnia libera; petala subsimilia breviora obtusa; labelli lamina tenuis oblonga obtusa apice biloba; columnæ dentibus acutis brevibus.

Central Madagascar, *Baron* no. 4128.

Allied to *B. Baronii*, Ridl., but a larger plant. Flowers bigger and fewer; lip thin, with the edges curled in beneath, and a bilobed apex.

BULBOPHYLLUM BARONII, *Ridl.*—Ankeramadinka. Flowers white. Dr. Fox.

BULBOPHYLLUM CONCHIDIOIDES, n. sp.—Planta pusilla cæspitosa, pseudobulbis ovoideis monophyllis $\frac{3}{16}$ unciæ altis, haud remotis; folia elliptica ovata crassiuscula ferme $\frac{3}{8}$ unciæ longa $\frac{1}{4}$ unciæ lata; scapi tenues gracillimi teretes unciam alti biflori; bracteæ ovatæ quam pedicelli brevissimi longiores; flores parvi $\frac{1}{4}$ unciæ longi, pallidi (sicci); sepalum ovatum lanceolatum obtusum, lateralia lanceolata subacuta, linea mediana obscuriore; petala ovata spathulata, $\frac{2}{3}$ lateralium æqualia; labellum glabrum, lamina ovata, marginibus subtus involutis, ungue brevi lato; columna brevis obliqua, alis latis tenuibus, dentibus brevibus acutis; anthera ovato-obtusa.

Central Madagascar, *Baron* no. 4471.

This species is allied to *B. seychellarum*, Reichb. f., differing in its smooth lip &c. The lip is ovate or almost ovate-lanceolate, but in the natural state the margins are so much curled in on the underside that it appears to be hastate. The texture is thin, and it appears to be of a reddish hue, while the rest of the flower seems to have been pale coloured.

BULBOPHYLLUM (sect. BULBOPHYLLARIA) OPHIUCHUS, n. sp.—Rhizoma crassum, vaginis pallidis membranaceis tectum; pseudobulbus angustus elongatus parum incrassatus biuncialis, vaginis 2 membranaceis pallidis amplis tectus. Folia circiter 4, lanceolata obtusa coriacea, apice vix biloba 6 uncias longa ¾ unciæ lata; scapus elatus 16 uncias longus, vaginis 6 dissitis membranaceis punctulatis laxis 1½ uncias longis; racemus densus erectus multiflorus 5-uncialis, rhachide carnosula; flores parvi virides (siccati rubescentes); bracteæ ovatæ obtusæ, floribus vix æquantes; sepalum posticum lanceolatum angustum, lateralia connata carnosula ovata; petala linearia spathulata papillosa abrupte recurva; labellum breve, lamina ovata hastata obtusa carnosa rugosula, subtus quasi complicata quam sepala multo brevior, unguis angustus linearis; columna brevissima, brachia brevia incurva, rostellum breve obtusum; anthera complanata biloculata, loculis valde discretis.

Ankeramadinka. Flowers green, turning red on fading.—*Dr. Fox*; *Baron* no. 4468.

This is the first recorded Madagascar species of the section *Bulbophyllaria*, which is characterized by the lateral sepals being connate into a somewhat fleshy ovate body. The petals are narrow and flat, with the ends a little broadened, covered with small warts, and folded back on themselves. They are apparently darker than the rest of the flower.

BULBOPHYLLUM GRACILE, *Thouars, Orch. Iles Afr.* t. 101.

Rhizoma lignosum; pseudobulbi dissiti oblongi conici 1½ uncias longi, vagina albescente, pseudobulbum et scapi basin tegente; folia anguste ligulata spathulata obtusa 3–5 uncias longa, vix ½ unciæ lata; scapus erectus vix pedalis validulus teres, parte inferiore vaginis paucis laxis dissitis, superiore laxe racemosa; bracteæ parvæ quam ovaria breviores ovatæ lanceolatæ acutæ; flores subsessiles; ovaria brevia conica; sepala ovata subacuta, lateralia breviter connata; petala multo breviora lanceolata lorata recta obtusa; labellum breve integrum oblongum subacutum abrupte convolutum carnosulum, lineis medianis tribus; columna alis latis, dentibus minimis obscuris; capsula ovata globosa ⅓ unciæ longa.

Central Madagascar, *Baron* no. 4129. Ins. Mascarenenses, *Sir J. Macgregor*.

I believe this to be the plant intended by Thouars's figure. It is closely allied to *B. ophiuchus*, mihi.

Bulbophyllum coriophorum, n. sp.—Rhizoma $\frac{3}{8}$ unciæ crassum lignosum, vaginis brunneis membranaceis tectum; pseudobulbus oblongus conicus $2\frac{1}{2}$-uncialis; folia bina? lanceolata, apice biloba 7 uncias longa $1\frac{1}{2}$ lata; scapus validulus erectus teres pedalis, vaginis laxis dissitis quarum suprema ampliata cucullata; racemus densus conicus, rhachide incrassata carnosa; flores parvi copiosi; bracteæ floribus æquales ovatæ subobtusæ; sepalum posticum lanceolatum obtusum quam labellum brevius, lateralia multo majora connata, apicibus solo liberis, carnosa semiovata, medio depresso, marginibus exterioribus acute carinatis, carina denticulata; petala quam sepalum posticum breviora anguste linearia lanceolata; labellum parvum carnosulum, lamina cordiformi; columna brevis, dentibus parvis; anthera compressa.

Comoro Islands, *Humblot* no. 337.

This plant is a very singular species, allied, as Professor Reichenbach ('Flora,' 1885, p. 544) intimates, to *B. conitum*, Thouars. The flowers in his specimen were deficient, so that he was unable to describe it. Those in the herbarium of the British Museum are in very good condition, and show that the plant is distinct from Thouars's species, which, however, I only know from his figure. In this plant, as in the rest of the section, the lateral sepals are connate and form an oval blunt body with a circular depressed space in the centre, in which lie the lip, petals, and columns. Round the depression the sides of the sepals are thickened and fleshy, while the outer edges taper off to a thin irregularly denticulate keel, while only the tips are free. In Thouars's figure of *B. conitum* I see no keel nor denticulate margin; the dorsal sepal, again, is represented as being longer than the lip, while in this plant it is shorter, and the column is figured without teeth, which are certainly present in this plant, although they are small. Lastly, *B. conitum* appears to have but a few flowers sunk in the fleshy rhachis, whereas *B. coriophorum* has a very large number. On the whole, therefore, I conclude that this is not the plant intended by Thouars under the name of *B. conitum.* The small flattened flowers with the denticulate margins bear some resemblance to some species of *Tingis* (Hemiptera), hence the specific name.

Liparis puncticulata, n. sp.—Caulis elatus 10-uncialis gracilis basi vix incrassata, vaginis membranaceis puncticulatis striatis dissitis multis $1\frac{1}{2}$ uncias longis tectus; folia 3–4 dissita patula

ovata lanceolata vel lanceolata acuta, 3 uncias longa 1 unciam lata (quo latissima), striata; scapus gracilis angulatus pedalis flexuosus; bracteæ remotæ lanceolatæ acutæ; flores olivacei, verosimiliter iis *L. longicaulis* æquales; sepalum posticum ligulatum angustum; lateralia late lanceolata obtusa 4-nervia falcata; labellum cuneatum bilobum, ungue angusto longo, lobis rotundatis divaricatis denticulatis; columna suberecta apice curvula, alis brevissimis obscuris; pedicelli graciles erecti, quam bracteæ multo longiores.

Central Madagascar, *Baron* no. 4334.

This is a very remarkable species, allied most closely to *L. longicaulis*, Ridl. Like that species it has a tall slender stem hardly at all dilated into a pseudobulb, but covered with a number of loose whitish membranous sheaths, which in this species do not overlap, there being a short but distinct space between each sheath. The sheaths are minutely dotted. The leaves, usually 4 in number, at the top of the stem, are a little separated from each other, and seem less thin in texture than those of *L. longicaulis*. The scape rises to a considerable height and is usually flexuous; numerous bracts are scattered throughout its whole length. The flowers are chiefly remarkable for the shape of the lip, which recalls somewhat that of *L. crenulata*, Lindl., having a long narrow base ending in a bilobed lamina, the ends of the lobes of which are denticulate. The claw lies parallel to the column, and at the bend there is a kind of rhombiform depression formed by two low ridges which run towards each other and almost meet. Down the middle of this depression run two veins slightly raised and sinuous. This rhombiform depression is, in the dry plant, of a darker colour than the rest of the lip. The stems of the plant, which is doubtless terrestrial, grow close together.

Liparis longicaulis, *Ridl.*, was obtained at Ankeramadinka by Dr. Fox; and L. flavescens, *Lindl.*, at Ambatovory.

Eulophia macra, n. sp.—Pseudobulbus oblongus subconicus biuncialis; folia 4 angusta linearia ultra pedalia (incompleta) $\frac{1}{4}$ unciæ lata; scapus circiter tripedalis, vaginis dissitis magnis ferme 3-uncialibus membranaceis acuminatis; panicula laxa diffusa, ramis tenuibus dissitis; bracteæ ramulorum angustissimæ lanceolatæ acuminatæ pallidæ, florales minutæ; flores parvi, iis *E. luridæ* æquales; sepala lanceolata acuta; petala subsimilia paullisper latiora, striis 4 obscuris conspicuis; labellum obovatum cuneatum margine fimbriato, venis medianis parce cristatis; calcar

breve clavatum saccatum obtusum, ovario multo brevius; columna brevis; anthera subconica, apice obscura.

Central Madagascar, *Baron* no. 3423.

A straggling plant with long narrow leaves and a lax thin panicle of small flowers. It seems to be most nearly allied to the West-African *E. lurida*, Lindl.

Polystachya fusiformis, *Lindl.*—Dendrobium fusiforme, *Thouars*. Angavokely, near Ambatovory, *Dr. Fox*, no. 39. To this species must be referred, I fear, my *P. minutiflora*. I was misled by a couple of flowers in the British-Museum Herbarium received from Du Petit Thouars as those of *P. fusiformis*, but which seem rather to belong to *P. cultrata*, Lindl.

Polystacha rosea, *Ridl.*, with flowers both purple and white, was obtained at Ambatovory by Dr. Fox.

Aeranthus polyanthemus, n. sp.—Radices lati crassiusculi; caulis biuncialis; folia angusta ligulata obtusa vix biloba striata, circiter 7 uncias longa $\frac{1}{2}$ unciæ lata; racemi graciles e basi caulis orti penduli 5-unciales, 9-flori; flores laxi mediocres viridescentes inexpansi; bracteæ lanceolatæ dimidio ovarii brevis subæquales; sepala lanceolata acuminata, lateralia basi angulata; petala subsimilia æqualia, basi dilatata vix angulata, $\frac{3}{4}$-uncialia; labellum basi concavum, marginibus brevissime lobulatis, medio perforato, lamina lanceolata subacuminata multinervia basi angustata; columna brevissima semiteres, rostellum breve, stigma semilunare; calcar breve crassiusculum obtusum incurvum.

Ambatovory, Imerina, no. 32. Flowers nearly transparent, greenish yellow.—*Dr. Fox*.

This species, a true *Aeranthus*, differs from *A. grandiflorus* and *A. Arachnites* in its closer raceme of many small green flowers. The lip is adnate to the base of the column and its base forms a somewhat deep depression, on each edge of which is a short blunt lobe. Just before the lip expands into its thin lanceolate pointed lamina, the basal depression is perforated by the entrance to the short blunt incurved spur. The blade of the lip is thrown up so as to be approximately parallel to the petals, and forms an angle with the pedicel. The lateral sepals have an abrupt angle, almost a lobe at the base.

Angræcum palmiferum, Thouars, is, I suspect, a near ally of

this plant; but I have only seen a single flower of it, in the British-Museum Herbarium, not in sufficiently good condition to base much upon.

Both the other species of *Aeranthus*, viz. *A. grandiflorus* and *A. Arachnites*, were also obtained by Dr. Fox at Ambatovory.

Æonia rosea, *Ridley.* Ambatovory, *Dr. Fox*, no. 26. This differed from the type in having a white lip. Some time ago I was shown at Kew a coloured drawing of a similar variety.

Mystacidium viride, n. sp.—Radices longi tenues; caulis subnullus; folia brevia oblonga ovata, $\frac{1}{2}$ unciæ longa $\frac{1}{8}$ lata, obtusa obscure inæqualiter biloba; scapi unciam longi tenues; flos singulus parvus viridis; bractea ovata acuta, quam pedicellus tenuis multo brevior; sepala atque petala anguste linearia recurva; labellum ovatum acuminatum cymbiforme concavum; calcar filiforme attenuatum ferme $1\frac{1}{2}$ uncias longum; columna brevissima; anthera depressa; polliniorum caudiculæ duo distinctæ complanatæ, discus singulus; pedicellus ovario bis longior.

Ankeramadinka, *Dr. Fox.*

This little plant, with its short blunt leaves and solitary flowers, is remarkable for the lip being continued directly into the spur without any break or bend at its junction. The long slender spur, too, looks quite out of proportion to the rest of the flower. Among Deans Cowan's drawings is a figure of a plant from "trees, Ankafana," which seems identical with this species. The flowers are light green.

Angræcum Calceolus, *Thouars, Orch. Iles Afr.* p. 78.—Aeranthus? Calceolus, *S. Moore, Flor. Maur. & Seych.* p. 353. Was obtained at Ambatovory by Dr. Fox. It has not hitherto been recorded for Madagascar, but occurs both in Mauritius and Bourbon.

Grammatophyllum Rœmplerianum, *Reichb. fil. in Gard. Chron.* 1876, p. 240, was omitted from my previous list of Madagascar Orchids. I have not seen it.

Cynosorchis speciosa, n. sp.—Tubera ignota; folia bina lanceolata lorata augusta, usque ad 10 uncias longa $\frac{3}{4}$ unciæ lata; scapus ultra pedalis validulus; vagina singula ampliata acuminata; racemus multiflorus laxus; flores magni, iis *C. unifloræ* ferme æquales; bracteæ lanceolatæ acuminatæ circiter $\frac{3}{4}$ unciæ

longæ; sepala oblonga ovata obtusa lateralia falcatula; petala multo angustiora lanceolata acuta; labellum magnum quadrilobum, unciam longum, lobis oblongis obtusis, apice paullisper dilatatis; calcar quam ovarium brevius pendulum versus apicem attenuatum; anthera dorso carinata; rostellum quadratum latum erectum quam antheræ apices multo brevius, antheram ferme superans; antheræ apices porrectæ angustæ subacutæ; stigmata ferme celata.

Ambatovory, no. 18, *Dr. Fox.*

This is allied to *C. angustipetala*, but differs in the foliage, lower racemes, &c. There are about twelve flowers in the race. "White, or sometimes pale pink, with a violet central spot."

CYNOSORCHIS GLANDULOSA, n. sp.—Folia bina lanceolata acuta flaccida, 6 uncias longa vix unciam lata; caulis debilis pedalis glanduloso-pubescens, vagina singula lamina lanceolata acuminata pubescens; racemus laxus multiflorus; bracteæ lanceolatæ acuminatæ, quam flores longiores glanduloso-pubescentes; flores parvi, sepala et petala subsimilia lanceolata; labellum cuneatum bifidum, calcar cylindricum versus apicem attenuatum ovari glanduloso-pubescente, multo brevius; antheræ apices pro genere breves, ferme recti; rostellum angustum; lobi ovati duo ad columnæ latera.

Angavokely; Ambatovory. "Dark-green, subpilose," *Dr. Fox.*

This is a near ally to *C. lilacina*, Ridl.; but is easily distinguished by its lanceolate leaves, smaller flowers, bifid lip, and short points to the anther. The whole plant, except the radical leaves and perianth, is remarkably glandular-pilose.

CYNOSORCHIS AURANTIACA, n. sp.—Tubera parva; folium singulum angustum lineare, quam caulis multo brevius; caulis gracillima hispida præsertim ad basin, vaginis tribus dissitis hispidis; racemus laxus; flores 8–9, iis *Bicornellæ parvifloræ* æquantes, aurantiaco-flavescentes; bracteæ lanceolatæ acuminatæ, $\frac{1}{3}$ ovarii æquantes; sepalum posticum galeatum ovatum acuminatum, lateralia angusta lanceolata deflexa; petala lanceolata acuminata; labellum trilobum porrectum, lobis lateralibus angustis linearibus falcatulis, medio longiore cuneato; calcar basi dilatatum hinc attenuatum curvum; antheræ apices porrecti, angusti, latera ad petalorum bases adnata; ovarium glanduloso-pubescens, quam calcar longius.

Ankeramadinka. "Lip flat, flowers orange-yellow," *Dr. Fox.*

Cynosorchis tenella, n. sp.—Gracilis; tubera parva; folia 4, radicalia oblonga ovata acuta 1–1½ uncias longa ¼ lata; caulis tenuis glaber, vaginis duabus acuminatis dissitis, 4–6 uncias longus; flores 4–5 dissiti parvi; bracteæ ovatæ acuminatæ vaginantes pedicellis æquales; sepalum posticum ovatum acutum, lateralia majora falcata oblonga obtusa patula; petala lanceolata; labellum porrectum trilobum, lobis lateralibus curvis subacutis, medio oblongo obtuso longiore; calcar breve clavatum, sepalis lateralibus subæquilongum; antheræ apices breviusculi curvi obtusi; rostellum subæquale; stigmata ovalia carnosa, haud celata; ovarium parce pubescens.

Ambatovory, *Dr. Fox.* Mohely, Comoro Isles, *Boivin.*

This little plant has much the appearance of *Habenaria tenerrima*, Ridl.; but is a true *Cynosorchis.* The other species obtained by Dr. Fox were *C. grandiflora*, Ridl., Ambatovory; *C. flexuosa*, Lindl., Ankeramadinka; *C. fastigiata*, Lindl., Angavokely; *C. lilacina*, Ridl., Angavokely and Ambatovory.

Habenaria conopodes, n. sp.—Caulis 18-uncialis foliatus; folia dissita patentia lanceolata acuminata longe vaginantia, basi amplexicaulia, longissimum 3 uncias longum, ½ unciæ latum; racemus laxus; flores iis *H. arachnoidis* æquales; bracteæ semiunciam longæ, lanceolatæ acuminatæ, ovario æquales; sepalum posticum lanceolatum obtusum erectum, lateralia subacuta deflexa; petala bifida, lacinia postica erecta linearis, antica angustior decurva; labellum trifidum, basi cuneata brevissima quam stigmata breviore, laciniæ longæ subæquales, angustissimæ lineares; calcar pendulum ovario subæquale clavatum acuminatum, apice paullo curvo; apices antheræ breves obtusi; stigmata longa porrecta obtusa, apice incrassata; lobi columnares laterales parvi ovati erecti obtusi. Planta sicca nigricans.

Ambatovory, *Dr. Fox.*

This plant is allied to *H. arachnoides* and it has very much the habit of *H. lancifolia*, Richard.

Habenaria Foxii, n. sp.—Radices copiosæ longæ, tubera ovalia; caulis 6–18 uncias longus, validulus foliatus; folia 5–6 ovato-lanceolata acuminata patula, 5 uncias longa 1½ lata; racemus laxus; flores plures mediocres virides; bracteæ inferiores lanceolatæ foliaceæ, superiores breviores angustiores, ovariis multo breviores; sepalum posticum erectum ovatum lanceolatum, lateralia subsimilia deflexa; petala bifida, laciniis angustis linearibus

ferme æqualibus, postica quam antica paullo latiore et longiore; labellum trilobum, lobis angustis linearibus obtusis subæqualibus; calcar elongatum clavatum porrectum, ½ unciæ longum, quam ovarium paullo brevius; apices antheræ breves oblongi obtusi; lobi columnæ laterales ovati breves; stigmata elongata porrecta oblonga obtusa, apice paullo dilatata; ovarium angustum, ¾ unciæ longum.

Shady woods, Ambatovory, *Dr. Fox*.

HABENARIA ICHNEUMONIFORMIS, n. sp.—Semipedalis; folia radicalia 2-uncialia lanceolata acuta angusta, caulina lanceolata dissita; flores pauci 4–5, laxi parvuli; sepalum posticum ovatum lanceolatum, lateralia lanceolata deflexa; petala ligulata erecta subobtusa; labellum profunde trilobum, basi brevissima, laciniis linearibus media quam laterales paullulo longiore, carnosulis; calcar elongatum ovarium multo superans filiforme, versus apicem dilatatum, hinc acuminatum; anthera gracilis, apices elongati curvi; rostelli lobus medius longus recurvus; stigmata brevia oblonga papillosa ad latera calcaris ostii; lobi columnares exteriores breves subtriangulares papillosi.

Central Madagascar, *Baron*, no. 3879.

The following species of *Habenaria* were also represented in Dr. Fox's collection:—*H. truncata*, Lindl., *H. Hildebrandtii*, Ridl., and *H. cirrhata*, at Ambatovory. *H. tenerrima*, Ridl., at Ankeramadinka. *Amphorchis calcarata*, Thouars, was found at Ambatovory. *Bicornella gracilis*, Lindl., was common in boggy places at Ankeramadinka and Ambatovory.

HOLOTHRIX GLABERRIMA, n. sp.—Tubera angusta elongata; folium singulum lanceolatum acutum glabrum 5-nervium; caulis erectus glaber subpedalis, vaginis longe acuminatis appressis tectus; racemus multiflorus densus secundus; flores parvi flavescenti-virides copiosi glabri; bracteæ ovatæ lanceolatæ acuminatæ; sepala angusta linearia obtusa; petala latiora lanceolata acuta, basi antica angulata; labellum trilobum basi angusta, lobi laterales breves falcatuli, medius lanceus acutus; calcar pendulum rectum acuminatum, ovarium superans; columna brevis, anthera subacuta, loculis discretis; rostellum breve subteres suberectum; lobi laterales columnæ (auriculæ Benthamii) rotundati papillosi.

Ambatovory, Imerina. Rare; open elevated downs, *Dr. Fox*.

This plant would almost form the type of a new subsection of the genus, differing, as it does, from the rest of the genus in the entire absence of any pubescence, and the erect lanceolate leaf; the rest of the species, as far as known to me, having one or two ovate or orbicular radical leaves lying flat upon the ground. The flowers are rather larger than in most species, densely packed in a secund raceme. According to a drawing made by Deans Cowan, they are greenish-yellow in colour. The lip is three-lobed, the lateral lobes shorter and narrower than the lanceate triangular middle one. There are, as in most species of the genus, two small oval granular bodies on either side of the column, homologous to the lateral lobes, or auricles, occurring in some of the *Habenariæ*. It seems likely that they are rudiments of the two lost stamens.

Satyrium gigas, n. sp.—Caulis validus elatus foliatus tripedalis; folia inferiora lanceolata oblonga plicata magna, 10 uncias longa, 3 uncias lata, superiora sensim in bracteas attenuata; racemus compactus multiflorus; flores pro genere magni; bracteæ lanceolatæ acuminatæ tandem deflexæ, flores superantes; sepalum posticum anguste lineare, lateralia falcata obtusissima minutissime ciliata; petala sepalo postico subsimilia subæqualia; labellum ovatum obtusum; calcaria longissima filiformia $1\frac{3}{4}$ uncias longa recurva; columna longa teres; anthera apiculata granulosa; rostellum subtriangulare latiusculum; stigmata biloba ovata elliptica.

Ambatovory, Imerina, *Dr. Fox.*

This is certainly the largest *Satyrium* known to me. The great size, long curved spurs, and narrow petals make it an easily distinguishable plant. Other *Satyria* obtained by Dr. Fox were:—*S. trinerve*, Lindl., common in damp places, Andrangoloaka, Ambatovory, &c.; and *S. amœnum*, Lindl., Ambatovory, not hitherto recorded from Madagascar.

Brownleea madagascarica, n. sp.—Tubera oblonga lanata; caulis ultra pedalis debilis; folia 3 dissita lanceolata acuminata amplexicaulia, 2 uncias longa, unciam lata, tenuia; racemus laxus 5–7-florus; bracteæ foliaceæ lanceolatæ, ovariis subæquales vel (inferiores) longiores; sepalum posticum petalis (dorsis nec marginibus) adnatum, apicibus liberis, galeam ovatam formans; calcar longum cylindricum recurvum, apice obtuso-truncato;

sepala lateralia lanceolata subfalcata; labellum brevissimum, lobo medio erecto lineari clavato; columna brevissima; anthera in dorsam reflexa, apicibus breviusculis.

Imerina, *Dr. Fox.*

This plant belongs to a small South-African genus not hitherto recorded from Madagascar. The present species is most closely allied to *B. cærulea*, Harv., differing notably in the petals being adnate to the upper sepal for the best part of their length. The petals are not attached by the margins as is usual in a galea formed of the sepals and petals, but by their backs; so that on the inside of the galea the edges of the petals are seen in the form of free ridges. The flowers appear to have been blue.

Platycoryne Pervillei, *Reichb. f.* Specimens from Baron, nos. 4545, 4579, agree very well with plants from Pervillé in Herb. Kew, and with Professor Reichenbach's description; but I cannot find any second lobe to the petals, as mentioned in the 'Genera Plantarum.'

Disa incarnata, *Lindl.* "Light red, with yellow spots. Damp banks, Ambatovory." *Dr. Fox.*

Disa Buchenaviana, *Kranzlin*=Satyrium calceatum, *mihi*, was obtained at Ankeramadinka by Dr. Fox.

Arnottia inermis, *S. Moore.* Andrangoloaka, *Dr. Fox.* This seems identical with the Mauritius species. It has not hitherto been recorded for Madagascar.

Professor Reichenbach, in 'Flora,' 1885, p. 537, refers *Monochilus gymnochiloides*, Ridl., to the genus *Cheirostylis*, under the name of *C. gymnochiloides*, Reichb. f.

Disperis tripetaloidea, *Lindl.*, has been obtained in Central Madagascar by Mr. Baron, no. 4288. It has not been hitherto recorded for the island.

Botanical Observations made in a Journey to the Naga Hills (between Assam and Muneypore), in a Letter addressed to Sir J. D. Hooker, K.C.S.I., F.R.S., by C. B. Clarke, Esq., F.R.S., F.L.S.

[Read 1st April, 1886.]

Kohima, Naga Hills,
Oct. 30, 1885.

My dear Sir J. D. Hooker,

I arrived here ten days ago. The station is 4750 feet alt.; and "Jakpho," distant 10 miles, is 9980 feet alt. Having heard that the vegetation here was totally unlike that of the Khasi Hills, I thought that there must be a great harvest of new species to be got here. But Col. Robertson, commanding now at Debrogurh, who knows both Kohima and Darjeeling, warned me that I should find Kohima to be very much Darjeeling over again. This I find so to be. Nearly all the plants that grow both in Sikkim and Khasia appear to grow here (the place is exceedingly rich botanically); besides these there is a large percentage of Sikkim plants not known in Khasia, and besides these there is a small percentage of Khasi plants not known in Sikkim, and a small percentage of new species. Also, the country here above 5000 feet being nearly all jungle (the open grass only small patches), the Sikkim plants altogether predominate in number of individuals, and make Kohima resemble Darjeeling, not Shillong. In marching upon Kohima, for miles together the road was so like that from Darjeeling to Mungpo that I could not have been sure that I was not in Sikkim; and the vegetation from Kohima to the top of Jakpho closely resembles that from the little Rungait to the top of Tonglo. I understand that about 30 miles south of Kohima I shall enter on open grass and the Khasi flora; and that the change from the jungle to grass is sudden. It is also to be recollected that the highest point in the Khasi Hills is under 6500 feet alt., and that therefore we could hardly expect Khasi plants between 7000 and 9980 feet alt. here. Still it is remarkable that we are on one range of hills here with Khasia not 100 miles off, while Darjeeling is not only 800 miles off, with the whole Brahmapootra valley between, but that Shillong comes almost in a line *between* this and Darjeeling,—yet the whole character of Kohima is totally unlike Khasia and very much like Darjeeling.

The country here may be divided much as you divided Sikkim,

viz. into:—1, the region of cultivation, alt. 2000–5000 feet; 2, the low level jungle below 2000 feet; 3, the upper level jungle, 5000–8500 feet; and 4, the small peak of Jakpho, 8500–9900 feet, where a subalpine flora with Rhododendrons just comes in. The rocks here are much as in Sikkim but more disintegrated; the upper levels (above 5000 feet) may be about as steep as the slopes in Sikkim at 5000–10,000 feet; but the cultivated region, 2000–5000 feet, are much more open, less steep, valleys, with evidently richer soil than Sikkim. Major Beresford, who accompanied me to Jakpho, again and again exclaimed, "I never saw such cultivation in all my life." The land is all terraced and irrigated, and covered with a heavy crop of a strong growing rice; it looks like the margin of the plain of North Italy near the lakes. There is also the common hill-rice as in Sikkim. The Naga Hills are as Sikkim, but with a vastly ameliorated climate, warmer, much less rain. The Nagas now are much what the Khasis were when you were among them; but the population here is very large instead of as in Khasia and Sikkim. The Nagas eat dog extensively (dogs are largely imported for the table from Muneypoor), in this point appoaching the Chinese.

It is perhaps rash for me to make so strong a statement about the vegetation of Kohima (and the levels above it) after being here but ten days; I will therefore offer a little detailed support of it before going further. I take the Commelinaceæ, the Indian species of which I know pretty well *specifically*. I have seen here *every* Sikkim species (except the *Pollia* with six perfect stamens), while not one of the species peculiar to Khasia have I yet collected here. I have only one new species, collected 1200 feet only above sea, an *Aneilema* of no interest except to a monographer.

Take *Rubus*: the Sikkim species abound, the two Darjeeling silver-leaved Rubi (one with 3-partite, one with 5-partite leaves) are here (not in Khasia at all); and besides these there is another simple-leaved silver-leaved species of the same section of *Rubus*, very handsome (I believe new).

Take *Senecio*: we have here *S. Wallichii* and its closely allied species (I forget specific name), unknown in Khasia; and we have here I believe nearly every Sikkim Composite that grows below 9000 feet. We have here, however, also *one* Khasi species, viz. the plant I called *Senecio Rabani*, which you have reduced in the 'Flora of British India' under another well known-species (to which it is very closely allied). I have also got two new *Senecios*,

very fine, but one *may* be *Senecio Simonsii*, which I have not seen for twelve years (I have no books nor even a list of genera), so I cannot say.

Take the Ferns: I have not one new species here yet. The middle-level species are mostly those that grow *both* in Sikkim and Khasia. The upper-level species are all Sikkim species and Sikkim *forms* (there is one exception noted below, viz. *Lomaria glauca*). Thus we have *Lastrea patentissima*, Wall., the "red-legged" Tonglo *Athyrium*; *Lastrea apiciflora*, var. *non-apiciflora*, abundant here at 9000 feet, exactly as at Tonglo at the same level. Indeed, so like are the Ferns to the Sikkim *forms*, that I doubt whether Levinge himself could say that a Kohima bundle did not come from Tonglo. I have seen no tree-fern here except *Asophila glabra* in the low levels.

But besides this, I see here numerous plants which I regard as representative Sikkim genera, and which I do not know from Khasia: such are *Patrinia*, *Notochæte*, *Dobinæa*, *Kalanchoe*. The "tasselled" straw-yellow *Cymbidium* is also here.

Nearly all the Natural Orders tell the same tale as the *Commelinaceæ*, *Rubus*, and *Senecio*; while, on the other hand, many common Khasi plants are conspicuously absent. I have not seen one plant here of *Impatiens chinensis*, so common in Khasia, nor of any of the other regular Khasi balsams. Nor have I seen here one plant of any species of *Lespedeza*, so prominent in Khasia. Nor have I seen here any one of the marked Khasi species of the Cheira Sacred Wood, or of the Shillong Hill.

The pines, and in a degree the oaks, are an exception. The only two pines I have seen here are Khasi species, viz. 1, *Pinus Khasiana*, of which I have only seen some poor trees at 5500 feet scattered in mixed tree-jungle at one spot; and 2, *Cephalotaxus Mannii*, Hook. f. MS., which I see scattered at 5000–8000 feet, and there are battered trees of it about 40 feet high on Jakpho at 9000 feet alt.

As to the oaks, they are in such grand force here, both as to species and individuals, that I have not nearly learnt them yet. I have collected nearly the whole Sikkim series here (not *Quercus Andersoni*); but there are also here several of the peculiarly Khasi species, such as *Quercus Griffithii*, A. DC., and the allied sessile-leaved Shillong species. There are here two oaks which I have seen before in herbaria but never collected, and I cannot recollect where they come from; and I have one oak which I do not

recollect ever seeing before. The great mass of the forests at 5000–8000 feet is oak all round Kohima; the most abundant tree at the 5000–6000 feet level is *Alnus*, I think the same species as in Sikkim. It grows here into a tree with an enormous trunk, some as big as the largest English oak I ever saw; but big trees of the *Alnus* are scarce, as the Nagas pollard it at six feet from the ground, and cut the innumerable sprouts for firewood.

I have also collected in the 5000–6000 feet level two *Diospyros*, largish trees, one with largish smooth fruit, the other with large hairy fruit, both of them trees that have a tropical, non-Sikkim, aspect to me.

The flora here is thus very interesting, and exceedingly rich, nevertheless my collections contain few new species. I had a vague idea that I could, in a mere passing visit, collect a nearly complete set of the Kohima species in flower in October; but, if for no other reason, I cannot do this for want of paper. Transport here is exceedingly difficult; the approach to Kohima is admitted to be the worst "line" in India; the sixty-four miles through the Nambre swamp-forests often take the Government convoys ten to twenty days, and the road is decorated with broken carts and the bones of bullocks, and sanded sometimes for half a mile with Government grain. Kohima is not a place where you can get paper of any kind. I have therefore in collecting often gathered only a scrap of the species where well known—this will be enough for identification.

In the richer soil and warm climate of Kohima many plants grow unusually large. One plant here which the English denizens have not overlooked is the Kohima thistle; it is abundant and attains fifteen to twenty feet (I am told that in some places it is twenty-five feet high); this is I believe only a large form of the Sikkim *Cnicus* (like our European *Cn. eriophorus*) with yellow flowers. Similarly I gathered here an enormous *Butea*; even of a small leaf of it the ordinary-sized paper cannot hold one leaflet; at first I thought it quite new, but I now believe it is only a large form of *Butea minor*, Wall. There is another "Carduoid" here (I forget the genus, but it is not *Cnicus*), which attains ten to fifteen feet, and is quite unlike my recollections of the plant (this may be sp. nova). The rice is, as I have stated, the Coix, and all the crops grow exceedingly strong. Naga-land is in fact a very rich country, and it is not a little place like Sikkim or Khasia; there must be 200 miles of it, all nearly equally good.

I have been up Jakpho; I went to the new summit, which is ascertained to be fifty feet higher than the old, and to the old summit also. The ascent is from "Kegwima," alt. 5800 feet, a village ten miles from Kohima. The ascent would thus appear 4000 feet, but in starting from Kegwima you go one and a half miles down hill to begin with, so that the whole pull up is about 5000 feet. It is a very easy ascent, no mountaineering at all, and you can get about anywhere; you are not confined to the path, nor is there a very grand path. I went up after a thirty hours' rain, and the lower half was very slippery (all this shaly Kohima mud); the top 1500 feet is excellent going; small Rhododendron trees with ferns below. I describe the ascent at some length, because you may have heard that it is a difficult or dangerous one. As a matter of fact it is made by many persons who do not profess to be mountaineers; and it is reckoned that *from Kegwima* it is four hours' march up. At the same time when I say the ascent is *easy*, I mean as to mountaineering; you will know what an ascent of 5000 feet up Tonglo with no well-used path implies, and Jakpho is still finer exercise (the lower part) from the slippery ground. Up to 9000 feet the vegetation on Jakpho is much as on Tonglo; there is one curious difference. You may recollect that all round Darjeeling from 6000–8000 feet the ground under the forest trees is covered with a grove of *Lomaria* (§ *Plagiogyria*) *pycnophylla*. On Jakpho, from 7000–9000 feet the ground under the forest is covered by the closely allied *Lomaria* (§ *Plagiogyria*) *glauca*; very densely covered, so as at this season to exclude nearly everything else. *Lomaria glauca* we reckon a rare fern in Khasia; here it is very plentiful and large. The Rhododendrons come in strong at 8500 feet; I only picked scraps of *Rh. arboreum*, *Falconeri*, and about four other species. They were not in flower of course, nor was the fruit near ripe; and I fancy Dr. Watt (who was on Jakpho in May) got all that is to be got; so I paid little attention to the Rhododendrons. The ridge on the very top, connecting the old and new summits, is clothed with dwarf bamboo (I suppose an *Arundinaria*) about six feet high, dense, and dripping wet. Just at the old summit where there is some open rock, and on one side a drop of 2000 feet at an angle of 80°, I collected several species (besides the ferns above mentioned by name), viz.:—

Arundinella (a large species).

Juncus (*membranaceus*, or an adjacent species).

Juncus, very slender, with small flowers.

Luzula, large; with long flowering-stems and basal tufts of broad green leaves.

Carex: a large broad-leaved species, perhaps an extreme state of *C. speciosa*, Kunth; collected also in Sikkim by Gamble.

Vacciniaceæ · three Tonglo species.

Microglossa: large shrubby, with white ray; but I think only a form of the common species.

Rubus: half a dozen species, 3 "silver-leaved"; moreover *R. moluccanus* on the very summit. I mean by *R. moluccanus* a species with undivided sub-5-lobed leaves which is abundant at 2000–4000 feet.

Senecio Wallichii, and its allied species; and the two common scandent Sikkim species.

Pimpinella (*Hookeri*, I think), *i. e.* the very fine cut species you got on Tonglo.

Ophelia: a 5-sepalous species with reflexed purplish corolla; a Sikkim species at 9000 feet.

Crassulad: a common Tonglo *Sedum*.

Pedicularis: a Tonglo species.

Ainsliæa: two species.

Actinidia.

Impatiens: the Tonglo small yellow.

Very near the top I saw the common Sikkim white *Michelia*. Also, there grew in great beauty a small Campanulad (*Codonopsis*). This species grows in Sikkim as a poor little straggling weed nearly prostrate, with few flowers; in Jakpho it forms small dense upright bushes about eighteen inches high—a mass of flower—I think 500 flowers on a single stem.

By working down 100–200 feet from the summit on the north-east face of Jakpho I came upon the two best plants I got, viz. too large *Senecios* of the section *Ligularia*. One of these is (I am pretty sure, without a book) the old *Ligularia racemosa*, DC., a plant which I have never seen in Sikkim under 11,000 feet; and Jakpho is much warmer than Sikkim at corresponding levels. The other is a *Ligularia*, five to six feet high, with very large leaves, and few florets to the head; it is therefore not a typical *Ligularia*. I am pretty sure that I have seen this plant before but I fancy not in Sikkim, but in or near Kashmir (this is only a fancy).

The levels 5000–7000 feet on Jakpho (and elsewhere here) are mostly forests of shrubby *Strobilanthes* six to twelve feet high, just as in Sikkim. The three or four species now in flower are Sikkim species.

There is a tree on Tonglo, at about 8000–9000 feet alt., which has been much noticed by the Europeans here, as they believe it to be the English holly. I thought they were wrong, though the leaf is much like *Ilex Aquifolium*. But I was not able to get either flower or fruit. The trees I saw were thirty to forty feet high, erect, with single cylindric stems about eight inches diam. The bark is clean, much like holly, and I now think the European residents may be right.

There are several laurels on Jakpho, two (at least) of which are *Litæas*; but I only saw the fruits of one laurel, which I did not collect as I could not get the leaves belonging.

The above account of my Jakpho ascent will explain to you that though the place is very interesting, it has hardly supplied me with one species that I know can be new. It seems to me that I may get here one or two new species in each large Order, but that I am not likely to get a new genus.

Up to 5000 feet the Convolvulaceæ are very prominent. The snow-creeper (*Porana*) is abundant about Kohima, and there is another small one here. At 1000 feet alt. is a splendid species with flowers fully as large as the Sikkim mauve *Porana*, but white, downy without. Of these large flowers there are twenty to thirty in each spike, and the spikes very numerous. It is a beautiful plant; but I have an idea that Kurz got it on the Karen Hills. From 2000 to 4000 feet alt. white-flowered Ipomæas abound, none I think new.

The gingers have been numerous here, but are now off flower. There remains one (a very fine one) like *Hedychium coronarium*, but with rich orange flowers (I think a new species). Also I got down in the Nambre forest, at 500 feet alt., a large *Roscoea* with purple flowers (many) in subquadrangular spikes. This also is a new species so far as I can recollect.

The orchids here are numerous (the European residents say very numerous), but not so many perhaps as in Khasia. I have collected several Sikkim species. Of peculiarly Khasi species *Vanda cærulea* is plentiful; also the *Cœlogyne* with brown fringed lip. There are two *Euhabenarias* still in flower.

In Rubiaceæ, as in so many other Orders, if you take the Flora of

British India, and make a list of every species common both to Sikkim and Khasia, that will give you very nearly what I have noted here. I have two (or three) species of *Spiradiclis, Carlemannia*, and two of *Coffea*. Also I have three species of one marked genus near *Myrioneuron* (this may be new, but I think not). There is one *Luculia* plentiful, I imagine the Khasi (not the Sikkim) species.

In the Nambre swamp forest I could not get at the trees. *Mucuna, Pueraria, Argyreia* abound. There is one gigantic climber with large racemes of dark red flowers (a Leguminosad) new to me. Leguminosæ are not strongly represented near Kohima. I have one that I suppose new, viz. of *Dumasia*, which "replaces" the species common in Sikkim. There is also in the Nambre forest, and up to 1500 feet alt., the curious small-flowered *Thladiantha*, which you got in Khasia; but I could not get one female plant either in flower or fruit; so the problem remains where you left it.

It is rather too late in the season to collect Cyrtandraceæ, but there are here all the species common to Sikkim and Khasia. Of *Æschynanthus* I have seen three species. In *Lysionotus* there is the common *L. ternifolia*, and there is also a bushy *Lysionotus*, five to six feet, hairy and with very slender peduncles: this I think is the imperfectly known *Lysionotus Griffithii*, of which Griffith collected some fruiting fragments in Upper Assam. In *Chirita* there is only in flower *Ch. acuminata*, R. Br., and *Ch. pumila*, D. Don. Of *Didymocarpus* I have only one in fruit; it is not any Khasi species. There are the usual *Rhyncoglossum* and *Rhyncotechum*. Then I have one or two scraps in fruit of a genus (somewhere near *Stauranthera*) which Griffith got in Upper Assam.

In Gentianaceæ, I have collected three *Ophelias*, two *Exacums*, one *Crawfurdia*.

I have collected no Primulad; I doubt there being many in these jungles at any season. *Ardisia*, with its small allied genera, is common here with several species; also *Mæsa, Myrsine, Embelia*, and one very large *Choripetalum*.

Begonias very plentiful, many Sikkim species; I have seen none that I suppose new.

Araliads numerous.

Acanthads not numerous (except *Strobilanthes*); there is *Thunbergia coccinea*, Wall., common. Also *Codonocanthus*.

Euphorbiaceæ seem to me fewer than in Sikkim; except *Antidesma* I have collected hardly anything.

I have collected here *Holmskoldia*, *Cardiopteris*, *Tacca*, and several other of such characteristic genera.

I have seen no Garciniad; nor any *Corydalis* or *Dicentra*; nor Crucifer (except one or two weeds); nor Capparid. I recollect no other Order well represented in Sikkim that is not *fairly well represented here.*

The list of plants at the top of Jakpho above noted is only of a few selected plants; I also saw *Polygonatum*, two species, *Koenigia*, *Anaphalis*, two species, *Epilobium*, *Pyrus*, two species, *Daphne*, *Viola*, &c., &c.; *all* I believe identical with Tonglo plants.

I do not intend to ascend Jakpho again as I do not think I shall get much more there. I shall endeavour to visit a patch of grass at 4000 feet, a few miles hence, also some patch of grass at 7000–8000 feet. Then I march to Muneypoor town (about ninety miles) and thence back to Cachar, about 140 miles. I go to Muneypoor so as to meet the Chief Commissioner, and the Governor-General's Agent there.

I enclose a few seeds of an *Elettaria* (?), or at any rate of one of those gingers that flower from the root. I do not imagine they can be of much value to you at Kew; but they are the only seeds that my hand has fallen on, and I send them to show that I have not forgotten your indent for seeds of any rare or beautiful plants.

Capt. Plowden, Commandant of the Frontier Police, tells me that only twenty miles hence, at the Kohima level (5000 feet), there is a piece of grass with Khasi pines, two days' march in length; and apparently the whole Khasi flora there comes in.

No plant I have collected here surprises me so much as a *Silene* which grows in the wet jungle near Kohima, at about 5500 feet. It is about three feet high, very straggling, hardly any leaves; in short I cannot recollect anything near it this side of Kashmir, but my memory may be defective.

Believe me to be,
Yours very truly,
C. B. Clarke.

Notes on the Botany of Western South America.

By JOHN BALL, F.R.S., F.L.S.

[Read 18th February, 1886.]

IN the course of a hurried journey round South America, I visited, in 1882, some points, chiefly on the western coasts of that continent, of which the vegetation is imperfectly known; and I have since endeavoured, by comparison of the available materials, especially those preserved in the herbarium at Kew, to clear up some doubtful questions relating to the distribution of species. I have thought it desirable to bring together such of the notes as I have made on particular places visited by me as appeared to contribute some slight additions to our existing knowledge, or to correct errors that have crept into works of authority.

Before entering into details, however, I would premise a few remarks on the climatal relations of the western sea-board of South America, which have had such a remarkable influence on the development of organic, and especially of vegetable life. For an accurate knowledge of the chief factors of climate—temperature and rainfall—we are unfortunately at a great disadvantage; for there are few equally extensive regions of the earth where meteorological observations are so scanty and so imperfect as on the west coast of tropical South America. So far as I know, none whatever are available from any point on the coast between Panama and Lima, a distance of fully 1600 miles; and our knowledge of the climate is derived merely from the testimony of travellers and the few Europeans who have resided in the country.

The Isthmus of Panama (between 9° and 10° N. lat.) has an annual mean temperature of about 81° F., rarely varying more than two or three degrees above or below that average. The rainy season extends for seven months, from May to November, with an average monthly fall of about 8½ inches, while during the relatively dry season, from December to April, the total rainfall for five months reaches the same amount, giving the rainfall in the year about 68 inches. The climate of the coast of Darien is said to retain the same general characteristics; but as we travel southward towards the equator the length of the rainy season gradually increases, until, in the Gulf of Choco and the adjoining coast, there is no season of even relative dryness, and heavy rains occur frequently throughout the year. The reports to this effect

were confirmed by my own brief experience on finding at Buenaventura, on open ground clear of the forest, an abundant growth of *Cyperaceæ* with a minute *Utricularia*, while, under a nearly vertical sun and a clear sky, the soil was everywhere moist.

The maximum of rainfall appears to lie some three or four degrees north of the equator, for the aspect of the coast at Tumaco, on the frontier of Ecuador, indicates a distinct change of climate: open spaces of grass-covered plain, affording good pasture to horned cattle, could not exist amid the perpetual moisture of the coast only 100 miles farther to the north. So far as I can learn, the low country of Ecuador between the Andes and the sea has what may be called the normal equatorial climate *—a rainy season extending through more than half the year, with an interval of comparative cessation of rainfall. There is reason, however, to conjecture that some projecting points on the coast, especially the Capes San Lorenzo and Santa Elena, are affected by the southerly currents of the air and ocean that maintain the exceptional aridity of the coasts of Northern Chili and Peru, and I shall have occasion to adduce some evidence to that effect.

The coasts of the Gulf of Guayaquil possess, as might be expected, an equatorial climate—an average temperature of about 82° Fahr., subject to very slight variation, with considerable though not excessive moisture. On the southern side of the gulf, at Tumbez, the frontier port of Peru, the same climate is said to prevail; but on issuing from the gulf and rounding the headland of Cape Blanco, little over 4° S. lat., an abrupt change of climate and vegetation is encountered. Under the influence of the cold Humboldt current which, issuing from the southern ocean, sets along the west coast of S. America, and of the breeze which constantly flows in the same direction, the mean temperature is reduced by more than ten degrees of Fahrenheit, and, the land being almost always warmer than the sea-breeze, rain falls very rarely and at long intervals.

The same conditions, with scarce any variation, prevail along the coast from Cape Blanco to Copiapó, or somewhat south of that place, over more than 23 degrees of latitude and a coastline of about 1700 miles. The maximum of aridity appears to be reached a little north of the Tropic of Capricorn; but the mean

* In some places near the equator there appear to be two rainy seasons in the year, with intervening dry seasons; but there are few indications of this phenomenon in equatorial America.

temperature on the coast throughout a great part of the year is nearly the same—from 68° to 70° Fahr. As we approach the southern tropic, differences of season become marked; and in Southern Peru and Northern Chili we encounter differences of from 10 to 12 degrees of Fahrenheit between the means of summer and winter. Throughout the whole region the mean temperature increases inland, even at considerable heights on the slopes of the Andes, as the influence of the southerly currents becomes less effective *.

Somewhat south of Copiapó the desert region of Western South America becomes gradually modified; the climate passes slowly from the state of excessive aridity to a medium condition somewhat resembling that of the drier parts of Southern Europe, where occasional, and sometimes heavy, rain in winter is succeeded by a long dry summer. Such is the character of the climate of Central Chili between the parallels of 31° and 36° S. latitude; and it is marked by the appearance of a peculiar flora, including a large number of endemic genera as well as species, for the most part nearly allied to forms inhabiting the middle and higher zones of the Andes. Even at Coquimbo, in latitude 30° S., where the average annual rainfall is said to be only about 1½ inch, a good many of the characteristic types of the flora of Central Chili are able to maintain themselves. It should be remarked that throughout the so-called rainless zone of Peru and Chili fogs frequently rest in winter on the hills near the coast, and that an appreciable amount of precipitation in the form of dew must be deposited. To this we must attribute the appearance of a comparatively abundant vegetation at that season, which has been observed at several places on the coast, as, for instance, on the hills about Lima. A recent journey of Professor Friedrich Philippi has made known the curious fact that on some of the higher ranges near the coast of Northern Chili, where cloud or fog is seen to rest during a great part of the year, abundant vegetation exists, including several plants of the moist region of Southern Chili. This ceases abruptly at the lower limit to which the cloud habitually extends.

In Southern Chili a very rapid change of climate occurs, owing to the influence of relatively warm westerly winds, which appa-

* In his excellent 'Handbuch der Klimatologie,' p. 127, Dr. Hann has discussed the general causes which, in tropical and subtropical regions, depress the coast-temperature on the western side of continents and raise it on the eastern coasts.

rently reach a maximum intensity about the parallel of the island of Chiloe. The change seemingly commences about lat. 36° S., and about a degree further south, at Concepcion and at Lota, is so marked as to affect materially the aspect of the flora by the disappearance of most of the characteristic types of Central Chili. We possess, unfortunately, no trustworthy observations of rainfall on the coast between Valparaiso, in lat. 33° S., where the average fall is little over 13½ inches, and Valdivia, in lat. 40° S., where it surpasses the average of 117 inches; while at Ancud in Chiloe, in lat. 42° S., it is said to reach the yearly mean of 137 inches.

Although the annual mean temperature is low, about 51° F., the mildness of the winters allows several plants of subtropical affinities (*Laurineæ*, *Myrtaceæ*, *Bambuseæ*, &c.) to flourish in Chiloe, where at Ancud the mean temperature of July, the coldest month, is 46° F.

From our limited knowledge of the flora of the Chonos Archipelago, it would appear that most of the representatives of subtropical types disappear about the parallel of 44° S., and that may be assumed as the northern limit of what naturalists have agreed to style the Antarctic Flora, and which extends southward with a surprising degree of uniformity to Cape Horn, over 12 degrees of latitude. It is true that several of the characteristic herbaceous types of the islands of high southern latitudes are represented in this region, and that there are plausible grounds for referring to south polar lands as the original home of a great portion of the flora; but, on the other hand, it may be urged that the climate of the entire region, however rude, is essentially temperate, and that the dominant features of the vegetation—the beech-forests, the abundance of delicate ferns (*Gleichenia*, *Hymenophyllum*, &c.), and such peculiar types as *Drimys*, *Desfontainea*, *Mitraria*, and several others—suffice to entitle the flora of this region to rank as a separate province, for which the name *Magellanic* may, perhaps, be appropriate. We possess but very incomplete data for discussing the climate save what are afforded by the vegetation, which is now fairly well known; but the fact that at Sandy Point, on the eastern side of the Straits of Magellan, south of the parallel of 53° S., the temperature of the coldest month (very nearly 35° F.) is higher than that of Holland or of the plains of Northern Italy, fully proves the exceptional character of the climate.

I proceed to give the following brief notes as to some places on the coast which I was able to visit.

Flora of Buenaventura in Colombia.

Buenaventura, a small port on the Pacific coast, about four degrees north of the equator, is, I believe, the chief place in the province of Choco in New Grenada. In the very short time allowed during the halt of the steamer I collected the following plants on the skirts of the forest close to the little town:—

Sauvagesia erecta, *L.* Indigenous in tropical America and in east and west tropical Africa.

Ryania chocoensis, *Pl. et Tri.* This species is known only from Buenaventura.

Vismia rufescens, *Pers. Syn.* ii. 86; *H. B. K. Gen. et Sp. Nov.* v. 182. Though long known, this appears to be a very rare species. I have seen only a single imperfect specimen in Kew Herbarium. Planchon and Triana find the Buenaventura plant to agree with the original specimen collected by Humboldt and Bonpland in Guiana (or Venezuela?).

Clusia ——? Collected in fruit. Approaches *C. pseudo-mangle*, Pl. et Tri., but is apparently different, perhaps an undescribed species.

Desmodium adscendens, *DC.* A species widely spread in South America and in the West-Indian Islands.

Conostegia polyandra, *Benth. Bot. Sulph.* A native of the coast-region of Southern Colombia and Northern Ecuador. Doubtless through error supposed to have been found in the Andes of Ecuador.

Clidemia dependens, *Don.* This is a very variable species, of which two forms were seen, one in open ground on the skirts of the forest, the other in more shaded places. It extends through equatorial South America.

Clidemia hirta, *Don.* This is widely spread in tropical America.

Nepsera aquatica, *Naud.* A native of tropical America, tending to the West-Indian Islands.

Miconia reducens, *Triana.* Known only from Buenaventura and the adjoining district.

Miconia symplocoidea, *Triana*. The only published locality for this species is the lower region of the Andes of Bogotá.

Miconia decussata, *Don*. This extends through equatorial America from Panama to Bahia in Brazil.

Spermacoce linearis, *H. B. K.* A native of Mexico and Venezuela. If *Borreria podocephala*, DC., should, as I suspect, be referred to this species, it has a wide range in tropical America.

Spermacoce parviflora, *Meyer*. This extends from Mexico and Florida through tropical America to the northern provinces of Argentaria.

Manettia asperula, sp. nov. As this differs considerably from all the described species, I have found it necessary to name it, and I here subjoin a brief description:—

Frutex alte scandens, ramis teretibus volubilibus; foliis integerrimis ovato-lanceolatis, apice acuminatis, breviter petiolatis, in pagina superiore asperulis; stipulis liberis ovalibus, pro genere magnis (2–3 lin. longis); pedunculis florigeris axillaribus, supremis solitariis paucifloris, inferioribus geminis oppositis, 8–10-floris; racemo (etiam fructifero) quam folia breviore; calycis segmentis 4, lineari-oblongis, acutiusculis, dentibus 4 alternis sæpe (nec semper) interjectis; corolla pro genere parva ochroleuca, extus strigosa, loborum margine ex pilis rigidiusculis patentibus ciliato.

I found this climbing over the smaller trees on the margin of the forest.

Anthopterus Wardii, *Ball in Hook. Ic. Pl.* ser. 3, v. No. 1465.

I reproduce the description above referred to:—"Suffrutex epiphyticus, glaberrimus, foliis alternis, ovatis, obtusiusculis, basi rotundatis vel subcordatis, margine integerrimo subrevolutis, subtus elevatim nervosis; floribus 5–10 in racemo brevi subcorymbosis; pedicellis fere pollicaribus, basi bracteatis, cæterum nudis; calyce cum pedicello pulchre coccineo, sub anthesi obconico, late alato, alis in pedicellum decurrentibus, segmentis liberis ovato-triangularibus, venosis, tubo subæquilongis; corolla urceolata, quinquealata, saturate rubra, fauce constricta breviter dentata, filamentis connatis."

This beautiful species was procured for me by my friend Mr. Richard Ward, to whom I have dedicated it. Being, at the same

time with myself, in a different part of the forest, he remarked the brilliant red flowers on the trunk of a tall tree, which was readily climbed by the negro who accompanied him. It is very different from the described species, *Anthopterus racemosus*, Hook. Ic. Pl. iii. No. 243, and *A. mucronatus*, Benth. Pl. Hartw., but approaches near to an undescribed species of which I have seen specimens in Kew Herbarium. One of these was collected somewhere in Peru by Maclean; the other is No. 2716 of Triana's plants of New Grenada. These specimens are in bad condition, but apparently belong to the same species. They differ from my plant in having shorter pedicels; the calyx-wings narrower, and seemingly not decurrent; the calyx does not appear to have the same brilliant red colour, which in my specimens continued to come off on the paper long after they were dry.

Utricularia —— ? In damp ground on the margin of the forest I found growing amongst *Cyperaceæ* a minute species of this genus, with very small flowers supported on stems about two inches in height. I have not been able to identify it; but as several very small species have been found in equatorial America, some of which I have not seen, I do not venture to name my specimens.

Solanum mammosum, *L.*, var.? On the bare branches of small bushes growing near the forest I found the fruits of a *Solanum*, the leaves being quite withered. The specimens, now in the Museum at Kew, appear to belong to a large-fruited variety of this species. The fruit is supposed by the natives to be so poisonous that they think it dangerous to handle it.

Euphorbia serpens, *H. B. K.* Apparently common here. The typical form of this species extends rather widely through the warmer parts of America; but a nearly allied form, ranked by Boissier as a variety, is spread through tropical Asia.

Alchornea —— ? The species of this genus are not easily identified in the dry state, and I an unable to name this.

Crinum erubescens, *Ait.* Growing in the deep shade of the forest. This, and several nearly allied forms, which should, perhaps, be regarded as varieties, is widely spread throughout equatorial America.

Tonina fluviatilis, *Aubl.* This has a wide range in tropical America.

CYPERUS LUZULÆ, *Rottb.* This appears to be confined to the equatorial zone of South America.

RHYNCHOSPORA TENUIS, *Willd.*=Dichronema gracilis, *Kunth.* A species with a wide range in tropical America, extending southward to Montevideo and northward to Mexico and Cuba. It is not to be confounded with the very similar species, *Rh. spermodon* of Grisebach=*Dichronema setacea,* Kunth. The latter has nearly as wide a range in tropical America, and, according to Böckeler, extends also to Australia.

FIMBRISTYLIS POLYMORPHA, *Böckl.*, var.=F. laxa, *Vahl.* A cosmopolitan species, with a wide range in the tropics and the warmer temperate zones.

FUIRENA UMBELLATA, *Rottb.* Like the last, this species extends round the world, but appears to be confined to the tropics.

PASPALUM CONJUGATUM, *Berg*, var.? The spikes are shorter and the florets decidedly larger than in numerous specimens from other parts of tropical America. The species is widely spread in tropical America, and also, as it appears, in tropical Africa.

PANICUM POLYGONATUM, *Schrad.* A tropical American species.

MENISCIUM RETICULATUM, *Sw.* Equatorial America.

LYCOPODIUM CERNUUM, *L.* Widely spread through the warmer regions of the world.

I did not attempt to collect arborescent ferns, of which several species were seen; and it is needless to say that, under the circumstances, it was impossible to obtain specimens of the larger trees forming the forest.

The very slight specimen which the above list affords of the flora of the Pacific coast-region of equatorial America suggests a doubt whether, as regards the warm and moist regions of South America, the differences between the floras of different portions have not been too much insisted on by writers on botanical geography, and especially by Engler in his valuable and important work, 'Versuch einer Entwicklungsgeschichte der Florenwelt.' He includes Venezuela and Colombia with tropical and subtropical Central America and Mexico, under the name "Subandine Province," as one of the great divisions of the American flora, making a separate botanical province of North Brazil and Guiana.

It will be noticed that, with a single exception, all the plants in the above list belong to genera that are widely spread throughout equatorial America, and that, including two new species and one doubtful, there are but seven species probably confined to the Pacific coast. It is extremely difficult to collect materials for comparison, inasmuch as the excellent, but unfinished, 'Prodromus Floræ Novo-Granatensis' of MM. Triana and Planchon includes only the Natural Orders of Thalamifloræ, probably little more than one tenth of the entire flora. I have analyzed the contents of the volume, omitting the mountain-species and taking account only of the genera which are represented in the warm zone of the Pacific coast, which may be reckoned to extend from the shore to a height of about 1500 metres, and I find that the 99 genera enumerated may be divided into the following categories:—

6	genera	cosmopolitan, *i. e.* widely spread throughout the world.
38	„	amphigean, *i. e.* in the tropics of both hemispheres.
46	„	tropical American, extending widely through the continent.
9	„	endemic, not extending far from the Pacific coast.
Total 99		

Several of the genera ranked as *amphigean* are represented in tropical America and tropical Africa, but not elsewhere in the world. A few of the tropical-American genera extend to the temperate zones in North or South America. The large majority extend to Brazil; but a few (four or five) do not appear to range beyond Guiana. It must be remembered, however, that this implies a range of at least 1600 miles from east to west, while the great majority extend over an area of at least 3000 miles in diameter.

The endemic genera are those demanding most attention.

Hampea and *Matisia* are genera belonging to the tribe *Bombaceæ*, which is, in many respects, intermediate between *Malvaceæ* and *Sterculiaceæ*. Along with two genera which are common to the tropics of the Old and New World, this tribe has developed a number of forms so distinct that they have been ranked as

separate genera, each consisting of one or, at most, very few species. *Hampea* has one species in Mexico and one in New Grenada, while *Matisia* appears not to extend beyond the lower eastern, northern, and western slopes of the Andes of New Grenada. To the same tribe belong seven other genera (of which four are monotypic) whose range is confined to limited areas in tropical America, and an equal number, of which also four are monotypic, are found in the tropics of the Old World.

Hasseltia, with only two or three species, is a genus of *Tiliaceæ* which appears to be confined to New Grenada; but I am not sure that it extends to the Pacific coast. The allied genus *Prockia* has a wide range in tropical America.

Pelliciera, a monotypic genus of *Ternströmiaceæ*, is a curious tree with the habit of the mangroves, and, like that tribe, inhabits the muddy shores of the Pacific from Buenaventura northward to Central America.

Cespedesia and *Godoya*—the former with four, the latter with two species—are genera of *Ochnaceæ*, whose range is said to be confined to Northern Peru and New Grenada, but which doubtless extend to the lower region of Ecuador. Along with four other allied genera inhabiting Guiana and Northern Brazil, they form the tribe *Luxembergiæ*, which is strictly confined to equatorial America.

Pilosperma, *Clusiella*, and *Balboa* are monotypic genera, nearly allied to *Clusia*, which are confined to the Pacific slopes of the Andes of New Grenada. The whole tribe of *Clusieæ* is confined to tropical, and mainly to equatorial, America. Although most of the species inhabit the warmer zone they have a very limited range, and several of them are mountain species inhabiting the middle zone of the Andes, between 6000 and 9000 feet above the sea. To this category, indeed, belongs *Clusiella*, which has not been found below the level of 6000 feet.

It is apparent from these facts that, if we may judge of the tropical flora of New Grenada from the portion hitherto published, it is not characterized by the presence of many peculiar types of vegetation. With the single exception of *Pelliciera*, the few endemic genera are nearly allied to others inhabiting other parts of tropical America, and belong to tribes which are elsewhere marked by the tendency to variation in portions of their structure that are held to constitute generic characters. Several of the generic types regarded as characteristic of the western side

of tropical America, are clearly of Andean origin, some species of which have been adapted to the climate of the lower region. To this category belong several genera of *Vacciniaceæ*, of which an example is found in the new species of *Anthopterus* above enumerated.

The conclusion to which I am led from a study, doubtless very incomplete, of the flora of tropical America, is that the vast region including the warm and moist parts of South and Central America should be regarded as a single Botanical Province, in which the same generic types are represented by species of which a large proportion are endemic, and confined to comparatively small areas. Along with these we find in various parts of the same region a few forms so distinct as to be ranked as separate genera, mostly represented by one, or very few, species, and nearly allied to types of wide distribution.

If along with these elements of the flora we find representatives of very different types of vegetation in many parts of the same great region, closer examination shows that, with rare exceptions, these are more or less modified forms of groups whose origin is either in the Andes or in the mountains of Guiana and Brazil.

If this view be correct, it undoubtedly entails the inconvenience that it is impossible for the phyto-geographer to make the natural divisions of the flora agree with defined geographical boundaries. But this is an inconvenience which has become apparent elsewhere in the world as well as in South America.

In a broad sense it may be said that the most natural divisions of the vegetation of the earth are wide areas of low country, over which, with more or less of modification, a limited number of types have extended, with islands of high land, which are the homes of the special types that form the characteristic features of the floras of different regions. From these mountain-centres we ordinarily find some representatives of these special types that extend through the low country to a greater or lesser distance from their original home, but as to whose mountain-origin there is little room for doubt. I am well aware that real or apparent exceptions to this view may readily be cited. Such, for instance, are the *Vochysiaceæ* of South America, which are now confined to the warm tropical zone. It is a fair matter for discussion whether it be more probable that they have originated in that zone, or whether the existing species are the modified descendants of ancestors that inhabited the ancient, and now

worn down, high mountains of Brazil. To some botanists the *Melastomaceæ* may appear to present a more important exception. Looking at the very numerous modifications which the earlier types of that family have undergone, and to their wide diffusion throughout the world, we are, in any case, forced to attribute to them a very great antiquity. Further, we find so many representatives of the chief American types of the Order inhabiting the subalpine zone of the Andes that, as it appears to me, the probability of their mountain origin is at least a not unreasonable hypothesis. An illustration of the view here defended is afforded by the tribe *Thibaudiæ* of *Vacciniaceæ*, which, excepting two Himalayan genera, are exclusively American, and mainly inhabit the slopes of the Northern Andes. Several representatives of the group, so distinct as to be ranked as separate genera, have extended to the tropical zone of equatorial America, and some of these appear in the islands of the Caribæan Sea. Yet few botanists, I think, would hesitate to regard the Northern Andes as the home whence these aberrant types have been developed. It is easily conceivable that in the course of their gradual migration, while exposed to many vicissitudes of external conditions, new species, and even new generic types would have been developed.

I cannot close this slight notice of the flora of Buenaventura without remarking that it is a spot well deserving the attention of any naturalist visiting South America. It is easy of access, is said to have a fairly healthy climate, and would afford a convenient centre for excursions in a region singularly rich in forms of life, and which has hitherto been very imperfectly explored.

Flora of Payta in North Peru.

Although there is very little to record, I think it may be useful to note the species collected during a walk of about two hours over the plateau behind the little town of Payta in North Peru. The vegetation of the hot and dry desert regions of the earth everywhere exhibits some common features. The existence of such regions is determined by the extreme scarcity of aqueous precipitation in the form of rain or dew. The surface being ordinarily rock, more or less covered with sand, few seeds are developed even on the rare occasions when sufficient moisture is present; and such plants as are seen are scattered at wide intervals. Annual species, which appear after the rare occasions

when sufficient rain has fallen, are speedily withered, and even perennials are often unable to survive the long intervals of drought. On the other hand, the climatal conditions are eminently favourable for the preservation of the vitality of many seeds which may be carried by the wind over wide spaces. One result, which has been frequently verified by observations in Northern Africa, is that at any given spot the vegetation is subject to singular variation in successive seasons. Some species disappear, while others, not before seen, exhibit themselves, and after a few seasons again give place to the old residents or to other new comers. The other result is that over a large area the flora is mainly composed of relatively few identical species which spread far and wide. Of the plants inhabiting the vast zone of desert, extending from Beluchistan to the Atlantic coast of Marocco, south of the Great Atlas, the large majority are found at intervals throughout the entire area. It would be of some interest to ascertain how far these conclusions are verified in the desert region of western South America, which extends northward, from about 27° S. latitude in Chili to about 4° S. lat. in Peru, through a distance of about 1700 English miles. The conditions are in some respects so different that we should expect the phenomena to be here less marked than in North Africa or Australia. In the first place the wind is much less powerful, rarely exceeding in force a gentle breeze, and it sets uniformly in the same direction from south to north. Hence this agency for the dispersal of seeds is less efficient, and while we should expect to find a good many species carried from Chili along the sea-board of Peru, this mode of dispersion cannot act in the opposite direction. Further than this, the desert zone is, for the most part, a narrow strip running parallel to the chain of the Andes, and many Andean types of vegetation have been modified to suit them to the climate of the western sea-board. From this source we should expect in the coast-flora a less amount of uniformity than is usual in desert-floras; but it seems likely that the causes which give rise to a great degree of variation in the vegetation of each particular place will act here much as they do elsewhere. To test this conclusion it would be well if travellers landing at various points on the coast would register the species observed at each place. Excepting the rare occasions when numerous plants enjoy a short-lived existence, the number of species to be observed is so small that the observation would give little trouble.

Payta lies about five degrees south of the equator, very near the northern limit of the so-called rainless zone, but within less than 100 miles of places on the southern side of the Gulf of Guayaquil which are described as within the region of tropical rains, and as possessing the characteristic vegetation of the Equatorial zone. Rain to an appreciable amount had not fallen for three years before the date of my visit, and the immediate vicinity of the port appeared to the eye absolutely devoid of vegetation. Assisted by several fellow-travellers, who were kind enough to join in the search, I think it probable that I collected every plant then to be found within a radius of more than a mile from the town on the plateau about 100 feet above the sea, which in most places approaches close to the shore. My collection contains only the following 12 species:—

TEPHROSIA CINEREA, *Pers.* A stunted form of this widely diffused species is found in many parts of tropical America, and extends southward to Monte Video and Buenos Ayres. It is wrongly described as an annual in Persoon's 'Enchiridion' and in DeCandolle's 'Prodromus.' It has a woody rootstock, sometimes an inch in thickness, and the branches are often woody at the base. *Tephrosia litoralis*, Pers., and *T. procumbens*, Macf., are scarcely distinguishable even as varieties, and several other described species approach very near, both in structure and appearance.

HOFFMANSEGGIA VISCOSA, *Hook. et Arn. Bot. Misc.* iii. p. 209. I believe that this species is confined to North Peru. It is true that specimens were distributed by Cuming with the label "Panama et Colombia occidentalis;" but there is reason to apprehend that the labels to Cuming's collections were affixed without any close regard to topographical accuracy *. The genus extends from the southern border of the region which I propose naming Argentaria, chiefly along the west side of the continent, to New Mexico, and thence eastward to Texas, and, like many other genera mainly American, has two representatives in South Africa.

PROSOPIS LIMENSIS, *Benth. in Hook. Journ. Bot.* iv. p. 350, *forma spinosa.* This appears to be a characteristic plant of the rainless zone of Peru, but I have not seen specimens from any

* It would seem as if but two labels were used for all Cuming's plants collected on the west coast of tropical America, between 18° or 20° S. lat. and 10° N. lat.—either that above quoted or "Lima et Peruvia septentrionalis."

locality farther south than the neighbourhood of Lima. Bentham (Trans. Linn. Soc. xxx. p. 378) has expressed a doubt whether this is more than a local variety of the wide-spread and eminently variable species *Prosopis juliflora*, Sw. In the paper quoted, containing his final views on the classification of this most difficult group of *Mimoseæ*, Bentham has united to *P. juliflora* not less than 17 species of *Prosopis* described by various authors.

ACACIA TORTUOSA, *Willd.* This and the nearly allied *A. macracantha*, H. B. K., have a wide range in tropical America.

ACACIA ——? A slender spiny bush without flower or fruit, so that the species, and even the genus, remain uncertain.

ENCELIA CANESCENS, *Cav.*, var. PARVIFOLIA. Having observed specimens of *Encelia* growing at numerous stations on the west coast of South America, I have no hesitation in asserting my belief that they were all forms of the same species, and that the form growing at Payta, which is *E. parvifolia*, H. B. K., as well as *E. oblongifolia*, DC. Prod., should be united to the original species of Cavanilles, it being difficult to fix their limits even as varieties. I venture to doubt whether Asa Gray's Californian species *E. farinosa* should not also be united to the older species.

COLDENIA DICHOTOMA, *Lehm.* A variable species, having a wide range on the drier portions of the western side of America, from the Tropic of Capricorn to Mexico. It has been erroneously described as an annual, as it has a woody rootstock. We are indebted to Asa Gray for uniting under the Linnean genus *Coldenia*, founded on a plant which extends through Africa and tropical Asia to the Philippines and Northern Australia, a number of allied American plants which had been ranked under five different generic names. Several of these are strikingly alike in appearance, yet exhibit great differences in the structure of the fruit. In regard to this I may express a suspicion, founded on the imperfect examination of several specimens, that in this group carpological differences such as usually mark generic distinction, may be found within the limits of the same species.

GALVESIA LIMENSIS, *Juss.*, var. GRANDIFLORA, *Benth. in DC. Prod.* x. p. 296. Found flowering in some abundance in the

little gullies that descend from the plateau to the sea-beach close to Payta. The form described by Jussieu, which seems to differ only in having smaller flowers, was first collected by Dombey near Lima, and has been since found at several stations in the dry country, about the foot of the Cordillera in Peru. The large-flowered variety is known, I believe, only from Payta and from Manta in Ecuador, whence there is a specimen in Kew Herbarium collected by Dr. Sinclair. I know very little of the coast-region of Ecuador north of the Gulf of Guayaquil, but I was struck by the arid aspect, as seen from the sea, of the portion, about 100 miles in length, between the headlands Cabo San Lorenzo and Cabo Santa Elena. It seems probable that this tract shares to a considerable extent in the influence of the Humboldt current, and the accompanying cool southern breezes which maintain the exceptional aridity of the coasts of Peru and Northern Chili. The presence of *Galvesia* at Manta, a small seaport close to the Cabo San Lorenzo, strongly confirms this conjecture.

I must here be allowed to express a doubt whether *Galvesia* should be maintained as a genus distinct from *Antirrhinum*. So long as we had to deal with the Old-World forms of the latter genus, where the mouth of the corolla is closed by the inflexion of the palate, or lower lip, the Peruvian plant appeared to be so far different that no one would have thought of ranking it in the same genus. But the progress of discovery in western North America has made known to us a complete series of forms connecting our common Snapdragon with species in which the mouth of the corolla is completely open. Two species in particular, *Antirrhinum speciosum*, A. Gr., and *A. junceum*, A. Gr., forming the section *Gambelia* of Gray and of Bentham, approach so nearly in structure to our *Galvesia*, that it seems to me that the latter must be placed in the same section of the genus, being in most respects intermediate between them in character and appearance, while the bright crimson corollas of the three closely resemble each other. *A. speciosum* was first described as the type of a new genus, *Gambelia*, by Nuttall; and *A. junceum* was described by Bentham, in the 'Botany of the Voyage of the Sulphur,' as *Maurandia juncea*. In preparing the general revision of the *Scrophularineæ*, for the tenth volume of DeCandolle's 'Prodromus,' Bentham left the last-named species in *Maurandia*, and in describing *Galvesia* remarks that it is

distinguished from *Antirrhinum* by the form of the corolla. Several years later, with the ample additional materials supplied by American explorers, Asa Gray, in one of those remarkable papers which he has published in the 'Proceedings of the American Academy of Sciences,' reduced the scattered fragments to order, and arranged the North-American species in sections of the genus *Antirrhinum*, including in the section *Gambelia* the *Maurandia juncea*, Benth. In his final revision of the Order for the 'Genera Plantarum,' Bentham adopted the views of Asa Gray as to the limits of *Antirrhinum* and the groups under which the American species should be classed; but he maintained the genus *Galvesia* for the Peruvian species. On a scrutiny of the generic characters assigned to this and to *Antirrhinum*, I can find only three points in which they appear to differ. The style in *Galvesia* is said to be minutely two-lobed. In several *Antirrhina* the tip of the style is slightly thickened, as in *Galvesia*, and the very minute cleft in the latter is all the difference that can be pointed out. The cells of the anther in *Galvesia* are said to be confluent at the summit, while in *Antirrhinum* they are separate. Although I have been unable to verify this character, I place absolute reliance on the unfailing accuracy of Mr. Bentham; but I do not know whether the anthers of the sections *Maurandella* and *Gambelia* of *Antirrhinum* have been examined, or whether the assigned difference has been found to exist. Finally, the cells of the capsule in *Galvesia* are said to open by an *irregular* pore below the summit. I am not sure whether Bentham considered the word *irregular* to indicate any important difference between *Galvesia* and the American *Antirrhina*, which have the capsule nearly or quite ovoid and the cells opening by a single pore to each cell. But in any case the difference is much less than that existing between the latter and the European species, in which the capsule is very oblique, one cell opening by a single pore, the other by two pores with toothed edges. I may mention that in *Galvesia* the corolla is more gibbous at the base, and therefore nearer to the typical *Antirrhinum* than it is in *A. junceum*. I must not omit to notice the fact that, from the figure and description of a plant brought from Cerros Island and described by Kellogg in the 'Proceedings of the Californian Academy,' vol. ii. p. 17, as *Saccularia Veatchii*, Bentham conjecturally added a second Californian species to the genus *Galvesia*, with which *Saccularia* appeared to him to be identical.

On comparing Kellogg's figure and description with the original specimens of *Antirrhinum junceum* I was struck by a suspicion that they refer to the same plant, and this suspicion was much strengthened on finding, in the 'Synoptical Flora of North America,' that Asa Gray has received specimens of *A. junceum* from Cerros Island, while he makes no mention of Kellogg's *Saccularia Veatchii*, a plant which does not appear to have been distributed. If my suspicion should be verified, it will go far to establish the conclusion that *Galvesia* must be united with the *Gambelia* section of the genus *Antirrhinum*.

[Since the above lines were written I have been informed by Dr. Gray that, in the forthcoming Supplement to the American Gamopetalæ described in his 'Synoptical Flora,' he has identified Kellogg's *Saccularia Veatchii* with his own *Antirrhinum junceum*, thus confirming my conjecture on this score. But he further informs me that on examining the living plant of *Gambelia speciosa*, Nutt., hitherto known only from dried specimens, he has found that the projecting palate closes the mouth of the corolla, as in the true *Antirrhina*; while it would appear, as well from Kellogg's figure as from the dried specimens, that the lower lip in *A. junceum*, A. Gr., is nearly or quite plane, as in *Galvesia*. This being the case, it would appear that, although *Galvesia* is nearly allied to some American species of *Antirrhinum*, it may be retained as a separate genus including *G. limensis* and *G. juncea*, the synonyms for the latter being *Maurandia juncea*, Benth. in Bot. Sulph., *Antirrhinum junceum*, A. Gr., and *Saccularia Veatchii*, Kell.]

LIPPIA REPTANS, *H. B. K.* A single plant without flower or fruit. It is, however, impossible to mistake the deeply plicated penninerved leaves of this species, which has a wide range in the drier parts of tropical America. *Zapania cuneifolia*, Torr. (*Lippia* of Steudel and recent authors), a native of New Mexico and Arizona, which has been overlooked by Schauer in the 'Prodromus,' appears to approach very near to the older species, but the leaves are less deeply plicated.

TELANTHERA DENSIFLORA, *Moq. in DC. Prod.* xiii. 2. 366. This is said to be a native of North Chili and (on the authority of Cuming) of Colombia. For the reasons stated above, no confidence should be placed in the latter locality. A specimen in Kew Herbarium from near Lima should probably be referred to this species.

TELANTHERA PERUVIANA, *Moq. l. c.*, var. DECUMBENS. This differs from the type specimens only in having the numerous short branches that issue from the woody rootstock prostrate instead of erect. The species appears to be confined to the arid coast-region of Peru. Cuming's specimen in Herb. Kew. is said to come from Lima, and specimens from Seemann and Spruce in the same herbarium were both collected in the desert of Piura.

EUPHORBIACEARUM, sp.? Two or three plants without flower or fruit, with leaves much like those of *Buddleia incana*, Ruiz & Pav., were seen growing on the bare stony plateau. I was told that the local name is *Sapote*, that the plant is considered poisonous, and that cattle, though eagerly devouring almost any green thing, will not eat the leaves or the fruit.

This meagre collection gives somewhat negative results. Of the twelve species seen two are indeterminable. Of the remaining ten species four are, so far as we know, confined to North Peru or its immediate neighbourhood, each having a maximum range of about ten degrees of latitude. Three other species that are confined to the Pacific coast have a much wider range, and two of these, at least, are nearly allied to plants inhabiting South California, Arizona, or New Mexico. Finally, three species are plants that range widely through tropical America and extend to the Atlantic coast.

A botanist who may be fortunate enough to visit Payta soon after one of the rare recurrences of abundant rain would doubtless find numerous annuals, of which none were seen by me, and his collections would probably throw a fresh light on the conditions of vegetable life in this region.

There is little worth recording respecting the other places which I was able to visit on the coast of Peru.

The flora of Lima and its immediate vicinity is pretty well known, as most botanists who have visited Peru have spent some time at the capital. Aided by the local knowledge of Mr. Nation, a resident at Lima (who, amidst many difficulties, has pursued the study of natural history), but at the least favourable season, I was able, in the course of three short excursions, to collect 101 species of flowering plants, chiefly in the gravelly bed of the Rimac or along the irrigation channels which alone render cultivation possible in this arid region.

Arica is one of the few spots on the coast where water from the Andes has made its way across the arid plains, chiefly through underground channels, and the result is to enable a good many species to maintain a continuous existence. On the sandy ground north of the port clumps of shrubby Compositæ, formed of *Pluchea Chingoyo*, DC., *Baccharis lanceolata*, Ruiz & Pav., *Tessaria ambigua*, DC., and *Trixis frutescens*, P. Br., rise to a height of six or eight feet. In as hort walk, during the brief halt of the steamer, I was able to secure 25 species, including among them the fine *Cæsalpinia Gilliesii*, possibly introduced for the sake of ornament.

At Tocopilla, a place formerly belonging to Peru, but now annexed to Chili, I, for the first time, found a spot absolutely devoid of all traces of vegetation. Our stay there was very short, but I went for some distance along the base of the rocky slopes that descend very near to the beach, and ascended here and there where the ground was not too steep. I was unable to detect the slightest speck of lichen on the rocks, and I was still more impressed by the appearance of the surface, which nowhere showed any indication of weathering. Even in the depressions the angles were all perfectly sharp, and there was no sign that water had ever flowed or trickled over the surface.

For a distance of nine degrees of latitude, or about 620 English miles, from Arica nearly to Caldera, the appearance of the coast, wherever we approached sufficiently near to examine it, showed the same unvaried aspect of absolute sterility ; but I was assured by competent witnesses that at several places rain has, at long intervals, been seen to fall in some abundance, and is certain to be speedily followed by the appearance of numerous flowering plants. At Taltal, a small place about 25° S. lat., the general aspect much resembles that of Tocopilla, but on landing and examining the rocks I was at once struck by slight indications of water action ; and on ascending a little steep gully on the slope I was able to secure three plants, two of which were in flower or fruit. One of these is a *Cristaria*, probably *C. Spinolæ* of C. Gay, or possibly the nearly allied form described as *C. foliosa* in the 'Florula Atacamensis' of Philippi. Many described species of this difficult genus, peculiar to temperate South America, are not to be found in European herbaria, and it is scarcely safe to express a decided opinion as to the value of the diagnostic characters assigned to them. The second plant found at Taltal, and also seen near Caldera, in each case without flower or fruit, may

perhaps be likewise referable to *Cristaria*, although very different in appearance from the first. If so it is probably *C. viridi-luteola*, Gay, nearly allied to *C. seselifolia*, Turcz. The third plant, which I found growing in some abundance at one place on the rough slopes, is certainly *Teucrium nudicaule*, Hook. Bot. Misc. ii. 235. This well-marked species appears to be one of the characteristic plants of the arid litoral region of Northern Chili, and to the best of my belief does not extend beyond it; but it is worth while to point out the errors, very excusable but very misleading, which have embarrassed in this as in many other instances the study of the botanical geography of South America. In 1830 Sir William Hooker received from Mr. Cruickshanks a considerable collection of plants from the western coast of South America. The large majority were collected in Peru in the neighbourhood of Lima, and most of these in the valley of Canta, while a small proportion were found in Northern Chili, chiefly at a place called Arqueros, north of Copiapó, and in the adjoining Atacama desert region. With his accustomed activity Sir W. Hooker described the plants of this collection, many of which were then new to science, in the 'Botanical Miscellany,' and in describing *Teucrium nudicaule* mentions the fact that the label had been mislaid, but that he believed the plant to have come from the valley of Canta in Peru. The consequence was that in the 12th volume of the 'Prodromus' Bentham gave that valley, with a note of interrogation, as one of the native localities for *Teucrium nudicaule*. Since that date no one of the numerous botanists who have visited Peru has found the species, while several specimens have been brought from the desert region of Northern Chili, chiefly from the neighbourhood of Copiapó. In C. Gay's 'Flora Chilena' the plant is said to inhabit Northern Chili, and Arqueros is specially mentioned as one locality. There can be little or no doubt that the plant originally sent to Sir W. Hooker came from that place. Besides the specimens from Northern Chili there is one in Kew Herbarium labelled "Concepcion, Bridges." If it were authentic this would be a fact of botanical distribution more anomalous than the supposed Peruvian *habitat*; for Concepcion, which is nearly ten degrees of latitude south of Copiapó, has a moist climate, and the general character of the flora is markedly different. I have found, however, that the same locality—Concepcion—is affixed to nearly all the Chilian plants sent by Mr. Bridges to Sir W. Hooker, probably because they

were despatched from that place, and no labels indicating localities were affixed to them. However that may be, it is abundantly clear that no reliance should be placed on these labels in Kew Herbarium as indications of the origin of the specimens to which they are affixed. Several of the plants so labelled are mountain species whose home is on the slopes of the Andes; many others are desert plants from Northern Chili. A few anomalies of distribution, if they stood apart, might not be altogether incredible, but that a single collector should have found a large number of plants, known to characterize other regions, at one single point on the coast where no other botanist has found them, may be safely dismissed from our belief.

It is remarkable that *Teucrium nudicaule* is not enumerated amongst the plants of the desert region in Philippi's 'Florula Atacamensis.' Under the number 268 he mentions, however, an uncertain species of *Teucrium*, of which the specimens had been lost, but which he had collected in two localities, and these most probably belonged to *T. nudicaule*, the only species of the genus hitherto known to grow in that region.

Flora of Caldera in Northern Chili.

A brief halt at Caldera, which I preferred to devote to a walk over the sandy and rocky flats near the port rather than to visiting the neighbouring town of Copiapó, enabled me to add a few interesting plants to my collection. For the first time since leaving Arica some appearance of vegetable life was visible on the coast, in the shape of a few bushes of *Baccharis confertifolia*, Colla, growing near the landing pier.

The following list includes the few plants collected, chiefly on the rocky ground about a mile from the port, with four others for which I am indebted to an English gentleman who casually gathered them in the same neighbourhood. As Copiapó lies at the southern border of the desert of Atacama, I have added a reference to the numbers under which most of them appear in the 'Florula Atacamensis.'

CRISTARIA VIRIDI-LUTEOLA, *C. Gay*? Quite uncertain, being without flower or fruit, but certainly the plant seen at Taltal.

FAGONIA ASPERA, *C. Gay* (*Phil.* 64). This appears to be, as C. Gay admits, no more than a variety of *F. chilensis*, Hook. & Arn.; but both are very nearly allied to the *F. cretica*, L., the

widely spread species of the hot and dry parts of the Mediterranean region. The wide diffusion of nearly allied forms of this genus in the desert regions of the Old World, of Western North America, and of Chili, is an interesting fact of distribution; and it is perhaps still more remarkable that in Chili both forms seem to be limited to a small zone and do not extend northward across the Atacama desert or into Peru. Philippi found our species no farther north than the neighbourhood of Caldera. Neither of the Chilian forms is more different from *Fagonia cretica* than are several described Oriental species which Bentham and Hooker are disposed to regard as varieties of the Linnean type. One is tempted to speculate on the possibility of an early introduction of the European species by the Spaniards and subsequent modifications of the type.

Loasa chilensis=Huidobria chilensis, *C. Gay* (*Phil.* 110). This appears to be strictly confined to the Atacama region. Although, as Bentham and Hooker have shown, there are no sufficient grounds for separating this generically from *Loasa*, it is a very distinct species with a peculiar habit. The flowering branches are often nearly glabrous, with very few of the glochidiate hairs characteristic of the genus.

Gynopleura rugosa=Malesherbia rugosa, *C. Gay.* Three species, all allied to *Malesherbia humilis*, Don, and inhabiting the arid region of Northern Chili, were described in the 'Flora Chilena,' and to these Philippi added three more found by him in the Atacama desert. Further observation is required to ascertain the constancy of the diagnostic characters adduced by these writers. My specimen closely agrees with those of *M. rugosa* received from the Paris Museum, where C. Gay's herbarium is deposited.

Cruikshanksia hymenodon, *Hook. et Arn.*? I cannot distinguish this from the original specimen preserved in Kew Herbarium, but I am unable to say whether the imperfect specimen given to me has a perennial root. *C. tripartita*, Phil. Fl. Atac. No. 165, differs chiefly in being an annual. It was found by Philippi, who does not enumerate *C. hymenodon*, at several places near Copiapó; but I have not seen specimens of his plant.

Baccharis confertifolia, *Colla in Mem. Acad. Tur.* xxxviii. 15 (1835) (*Phil.* 193)=B. Chilquilla, *DC. Prod.* v. 419 (1836) =B. marginata, *DC. Prod.* v. 402 (1836)=B. parviflora, *Pers.*

non Poir. (*sec. DC. l. c.*). Most of the specimens in herbaria labelled *B. marginata*, DC., and *B. glutinosa*, Pers., should be referred to this plant, which should retain Colla's older name, unless they should all be considered as forms of *B. glutinosa*, Pers., as to which I am somewhat doubtful. *B. confertifolia* has a rather wide range on the western side of S. America from Central Chili to Peru. A specimen in Kew Herbarium from Santiago del Estero in Argentaria, and named by Grisebach *B. glutinosa*, Pers., is certainly different from *B. confertifolia*, the nervation of the leaves being quite dissimilar.

ENCELIA CANESCENS, *Cav.*, var. TOMENTOSA = E. tomentosa, *Walp.* (*Phil.* 218). As I have already remarked, all the specimens of *Encelia* from South America seen by me appear to be referable to *E. canescens*. The present variety is very near to A. Gray's *E. farinosa* from California.

SKYTALANTHUS ACUTUS, *Walp. et Meyen* (*Phil.* 228). This small bush is rather abundant in some spots near Caldera, but its area seems to be extremely limited, not having been hitherto found except in this immediate neighbourhood, though too conspicuous to be overlooked. The authors of the 'Genera Plantarum' have maintained the name *Skytanthus* as originally written by Meyen, though the discoverer of the species subsequently corrected the name so as to conform to its correct etymology.

COLDENIA LITORALIS, *Phil. Fl. Atac.* No. 248. Philippi found this species on the sands of the sea-shore near Caldera; I found it in some abundance on the sandy flats about a mile inland, with cream-coloured flowers having much the appearance of a *Frankenia*. It is certainly distinct from *C. dichotoma*, having the calyx-segments longer and divergent when in fruit, while in *C. dichotoma* they are adpressed and usually close together over the fruit. The nutlets in the Caldera plant are subspherical and granulated on the surface, while in *C. dichotoma* they are smaller, ovoid, nearly black and polished. The leaves also are different, being distinctly petiolate in *C. litoralis*, and in *C. dichotoma* sessile but tapering to the base.

CHENOPODIACEARUM, sp.? Too imperfect. Even the genus uncertain.

STIPA TORTUOSA, *Desv.* (*Phil.* 392). This species appears to be rare and confined to Northern Chili.

STIPA CHRYSOPHYLLA, *Desv.* This is described and figured in the 'Flora Chilena' (tab. 76), but is not included by Philippi among the species collected in the Atacama desert. The specimens distributed from Cl. Gay's herbarium were found near Copiapó.

The flora of Coquimbo is sufficiently well known, but it includes several curious plants which appear to be confined to a narrow zone of northern Chili. On the hill behind the town I found, among others:—*Cassia coquimbana*, Vog., a very ornamental plant in full flower; *Ophriosporus triangularis*, Meyen; *Haplopappus hispidulus*, DC., and *H. parvifolius*, A. Gr.; *Gnaphalium ulophyllum*, Hook. et Arn.; *Cephalophora litoralis*, Phil.; and *Cochranea stenophylla* (Hook. et Arn., sub *Heliotropio*). I also observed a dwarf *Mammillaria* with crimson flowers growing in some abundance, but of which I found but a single specimen in flower. It appears to be undescribed, but I do not venture to name it.

No place in South America is better known to naturalists than Valparaiso, and although I visited it at the most unfavourable season, at the end of autumn (May), and before the first winter rain had fallen, I was struck by the exceptional abundance and variety of the vegetation for a region possessing a warm climate with a mean annual rainfall of only 13½ inches.

Flora of Lota in Chili.

My short visit to Lota, a port about 20 miles south of Concepcion, was chiefly occupied by the remarkable garden, or park, of Madame Cousiño, the owner of the mine of excellent lignite which has raised this to a place of commercial importance. A temperate climate, with sufficient rainfall (probably about 40 inches a year)*, makes this spot admirably fitted for the cul-

* The observations of rainfall at stations in Chili exhibit results so inconsistent that it is difficult to feel any confidence in many of them. There is reason to believe that the observations at Santiago are carefully recorded and that a suitable instrument is there employed, but as regards the other stations equal reliance cannot be placed in either respect. The chief cause, however, of the great discrepancies to be found in the published tables is the extreme variability of the climate, especially of Central and Northern Chili.

In an interesting work by Don B. Vicuña Mackenna, entitled 'Ensayo Histórico sobre el clima del Chile,' that author has traced back from the early records to the present time the recurrence at irregular intervals of exceptional seasons with excessive rainfall or extreme dryness, and has shown that, even in years that cannot be called exceptional, the rainfall in successive years frequently varies in the proportion of 1 to 2 or 3. It is obvious that the results for a

tivation of plants of various regions; and, although it is surpassed by many others as regards the variety of species under cultivation, I have seen very few to equal it in interest.

Of indigenous plants very few were in flower, but the beautiful *Lapageria rosea* in full bloom, climbing over the shrubs and smaller trees, was alone sufficient to adorn the scene. The following short list includes chiefly the indigenous plants found on the low cliffs facing the shore, but also at least four species introduced from Europe which have apparently become naturalized of late years.

Linum aquilinum, *Mol.*, *Hook. et Arn. Bot. Misc.* iii. 149 = Linum Macræi, *Benth. Bot. Reg.* 1326. This extends along the coasts of Central and Southern Chili from Valparaiso southward.

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comparatively short period which are available for most of the stations mentioned below must vary very widely according as years of excessive rainfall or exceptional dryness happen to be included. As the best available sources I have compared the measurements given in millimetres by Dr. Julius Hann in his 'Handbuch der Klimatologie,' by M. V. Raulin, in the 'Zeitschrift' of the Austrian Meteorological Society, vol. xi. p. 137, and by D. B. V. Mackenna in the work above cited, for the places of which the latitude is set down.

Stations.	S. latitude.	Hann.	Raulin.	V. Mackenna.
		mm.	mm.	mm.
Copiapó	27° 22′	8	7·9	9
Serena	29 54	40	38·5	39
Valparaiso	33 1	340	343	350
Santiago	33 27	360	358·2	419
Constitucion	35 20	......	....	536
Talca	35 26	500	504	527
Concepcion	36 49	......	2366	1364
Valdivia	39 49	2930	2933	2557
Corral	39 52	2530	2531·8	......
Puerto Montt	41 30	2450	2448·7	2333
Ancud	41 46	3400	1320·9	2035
Punta Arenas	53 10	570	572·8	495

With two exceptions the figures given by Dr. Hann and M. Raulin are evidently derived from the same materials; but the sum set down by M. Raulin for Concepcion is anomalously high, while that for Ancud is little over one third of that given by another set of observations. If, as appears probable, the rainfall of 536 millim. at Constitucion is nearly correct, it is not probable that at Concepcion, only $1\frac{1}{2}°$ farther south, the average amount is more than twice as great. Having consulted M. Raulin on the subject, that gentleman has been good enough to inform me that he places no confidence in the result for Concepcion recorded by him as expressing the annual mean rainfall of that place, and I incline to believe that even the smaller figure (1364 millim.) is above the average rate.

Oxalis laxa, *Hook. et Arn. Bot. Beech. Voy.* i. 13? This approaches near to *O. albicans*, H. B. K. *O. laxa* extends from Coquimbo to Chiloe, while *O. albicans* has a rather wide range in tropical America.

Francoa sonchifolia, *Cav.* The five described species of this genus, which is peculiar to Chili, are very nearly allied; and Mr. Rolfe ('Gardeners' Chronicle,' for 26 Aug. 1882) has therein maintained that the genus consists of a single variable species. My opportunities for studying the question have been insufficient, but I may remark that if his conclusion be adopted the name *sonchifolia* should be retained in honour of its original discoverer Feuillée, who ('Journal des Observations,' ii. 742, tab. 31) has given a very accurate description with a correct figure of the flowering plant, under the name *Llaupanke amplissimo Sonchi folio*. It extends through Central and Southern Chili.

Eugenia apiculata, *DC. Prod.* iii. 276? = E. Luma, *Berg.* According to C. Gay this species is confined to Southern Chili, and there is a second (allied) species, not described by him, to which the Lota plant may perhaps be referred.

Griselinia alata, sp. nova. This plant has long existed in herbaria, but has not been described. It was apparently first collected by Macrae near Concepcion, and subsequently at Lota by Lechler. I found the male flowers fully opened, and the female plant with ripe fruit and with flowers just expanding. It appeared to grow as an epiphyte at the base of some of the larger trees in the park (*Myrtaceæ* or *Laurineæ*), but in my haste I failed to ascertain the point with sufficient care. I subjoin the description.

Frutex (ad basin arborum epiphyticus?) ramosus; ramis rigidis quadrangulis, junioribus (præsertim pl. femineæ) late alatis; foliis elliptico- vel ovato-lanceolatis acutis, margine integris, vel basin versus spinoso-denticulatis, coriaceis, nitidis, in pagina inferiore insigniter reticulato-nervosis, brevissime petiolatis, petiolo cum ramo articulato; inflorescentia paniculata, pedicellis brevibus floribus subæquilongis, pubescentibus, cum flore articulatis; floris masculi filamentis brevibus; antheris lateraliter dehiscentibus; floris fœminei apetali calycis dentibus minutis; ovario uniloculari; bacca monosperma. Species distinctissima, ramis alatis, forma foliorum, cæterisque notis insignis.

It is remarkable that Grisebach, who, in his memoir on the collections made by Philippi and Lechler in Southern Chili, has described a new species of this genus under the name *Decostea iodinifolia* ('Bemerkungen', p. 34), should not have been acquainted with the present species, which appears to have been twice distributed by Lechler (under numbers 1481 and 3269). There can, I think, be no second opinion as to the propriety of uniting *Decostea* of Ruiz and Pavon with *Griselinia*, as first proposed by Baillon; but there may remain room for discussion as to the true place of the genus in the natural arrangement. In the memoir above cited (pp. 18 *et seq.*) Grisebach has discussed the affinities of *Decostea* at some length, and has shown that in many important respects it approaches more nearly to *Ilicineæ* than to *Corneæ*, amongst which it is placed in the 'Genera Plantarum.' It adds one more example of a group of vegetable forms intermediate in structure between families which in the course of development have diverged from the ancestral type in different directions.

The geographical distribution of all the known species points to the probable origin of *Griselinia* in the lands of high southern latitudes. With the exception of one species found in the Organ Mountains in Brazil, the genus is known only in New Zealand and on the west side of South America.

Scabiosa maritima, *L.* Certainly introduced from Europe, now naturalized.

Eupatorium glechonophyllum, *Less.* This species appears to be common in Central Chili, not extending far to the north of Valparaiso, while Lota is near to its southern limit.

Baccharis Eupatorioides, *Hook. et Arn.* A native of Southern Chili whose northern limit is apparently about Lota. There is a specimen in Kew Herbarium, collected by Dr. Eights who accompanied a United States surveying expedition, labelled "La Moche Island, S. Pac. Ocn." This name was doubtless taken from a French chart, and indicates the small island of Mocha, about 20 miles from the coast, and about a degree S. of Lota. Dr. Eights collected plants in several other islands on the Chilian coast, to which on the labels has been added the descriptive phrase, "South Pacific Ocean." Though not incorrect this is certainly misleading.

Anthemis Cotula, *L.* Introduced from Europe, but thoroughly naturalized in Chili.

Cotula coronopifolia, *L.* A cosmopolitan species, whose origin in America is uncertain. It is undoubtedly indigenous in Australia, Tasmania, New Zealand, and in Southern Africa, but is now thoroughly established in many other parts of the world. Antarctic islands may have been the original home of this and several allied species.

Senecio vulgaris, *L.* Apparently of recent introduction in Chili, but now naturalized. It is not included amongst the 113 species of *Senecio* described in the 'Flora Chilena.'

Mutisia ilicifolia, *Cav.* Like most species of this singular genus this has its proper home in Chili. It has been found at several places in the Andes, and extends southward to the island of Chiloe.

Hypochœris Lechleri? My single specimen closely agrees with a plant found by Lechler in the province of Valdivia, and named by Schultz Bipontinus *Achyrophorus Lechleri.* In his revision of the species of *Achyrophorus* ('Pollichia,' 1859, p. 66) Schultz subsequently identified his own *A. Lechleri* with *A. tenerifolius,* Remy. That name is objectionable as being too like the older name *A. tenuifolius,* DC.; and if this be retained as a species it may best be called *Hypochœris Lechleri.* It appears to me that the species of this section of the genus *Hypochœris* have been unduly multiplied; but I have not had access to sufficient materials to form any judgment as to the true limits of the numerous forms that abound in Chili and Peru. I should conjecturally refer this as a variety to *H. apargioides,* Hook. et Arn. (sub *Seriola*).

Crepis virens, *L.* Doubtless introduced from Europe. Lechler collected a *Crepis* somewhere in this part of Chili which appears to have been named, but not published, by Schultz Bipontinus as *Crepis Lechleri*. In Kew Herbarium there are specimens of *Crepis virens* from Valdivia; but no botanist has detected any indigenous species of *Crepis* in Chili, and it is allowable to suspect that Lechler's plant, which I have not seen, is merely a form of the common European species.

Lobelia tenera, *H. B. K.* This does not appear to have

been found elsewhere in Chili, and may possibly be an escape from the Garden at Lota. It is indigenous in Peru, Ecuador, and Venezuela.

DESFONTAINEA SPINOSA, *Ruiz & Pav.* This remarkable plant extends in South America from Fuegia to the Andes of Ecuador and Colombia in several forms, showing considerable varieties of foliage, which have been described as distinct species; but these are connected by intermediate forms. Its true affinities were fully discussed by Bentham in the first volume of this Journal; but it has no close alliance with any other existing genus, and its origin must be sought at a remote period of vegetable history.

LORANTHUS ESCHSCHOLZIANUS, *Mart.* First found by the traveller whose name it bears in the neighbourhood of Concepcion. It appears to be confined to this part of Chili.

RHODOSTACHYS BICOLOR, *Benth. et Hook. f. Gen. Pl.* iii. 662 = Bromelia bicolor, *Ruiz & Pav.*? A very singular and highly ornamental plant, which appears to be common on the sea-cliffs about Lota. The flowers, which are crowded into a nearly flat sessile head, are surrounded by a large rosette of rigid leaves, spinosely serrate, with the upper surface bright red (almost scarlet) along the middle, and green at the edges. The lower leaves are more than a foot in length, and gradually pass into papyraceous oblong bracts, fimbriate at the summit, surrounding the head of flowers. These bracts are of a paler rose hue, and the innermost almost pure white. The leaves are broader than in specimens of *R. bicolor* which I have seen, and my plant does not exactly agree with the descriptions of the seven or eight published species, most of which appear to be little known, and several are not to be found in European herbaria.

LAPAGERIA ROSEA, *Ruiz & Pav.* This beautiful plant belongs to a group of genera which Bentham classed as a distinct tribe of *Liliaceæ*, intermediate between *Asparageæ* and *Polygonateæ*. Of the seven genera four are monotypic, and none contains more than three species. Three genera are confined to extratropical South America, one is limited to South Africa, and one to Australia. Of those remaining, one is represented by a single species in Australia, and by another nearly allied in New Caledonia and the Pacific Islands; while the last, *Luzuriaga*, has two species in Chili, and a third which is common to Magellania and New Zealand. These facts, which point to the extinction of a large

number of intermediate types, suggest the probability of a very remote origin of the entire tribe in high latitudes of the Southern hemisphere.

Nothoscordum striatum, *Kunth, Enum.* iv. 459 = Allium striatum, *Jacq.* This species seems to have a very wide range in America, extending from Canada to Chili and Argentaria, supposing that the plant mentioned by Grisebach as *Allium euosmon*, Lk. & Ott., is one of the numerous forms which have been described as distinct species by various authors, but are united to *N. striatum* by Regel in his excellent monograph of the genus *Allium*.

Scirpus setaceus, *L.*, var. pygmæus = Isolepis pygmæa, *Kth.* Böckeler has judiciously united the several forms of this cosmopolitan species. This variety is mainly spread throughout the Southern hemisphere. Böckeler mentions Crete as a locality; but if I am not mistaken it has been found in many other stations in the Northern hemisphere.

Gleichenia cryptocarpa, *Hook.* This is a characteristic form of Southern Chili, and appears to have been found also in the Falkland Islands.

Gleichenia pedalis, *Kaulf.* Known only from S. Chili and the island of Juan Fernandez.

Alsophila pruinata, *Kze.* This extends from the West Indies through the moister parts of tropical America to the Chilian coast, but does not appear to have spread southward on the east side of the continent.

I traversed the Channels of Western Patagonia and the Straits of Magellan in June, after the winter season had fairly set in; and of course I was not able to collect many plants in a satisfactory condition. I was able to land at two places in the Channels—Eden Harbour and Puerto Bueno. The former appears to be an excellent station for a botanist, as it offers considerable variety of ground. Although the superficial crust of spongy soil was hard-frozen, many delicate plants appeared to be unaffected by the season. Amongst other interesting species I gathered *Pseudopanax racemiferum* (Miq., sub *Sciadophyllo*) = *Aralia lætevirens*, Fl. Chil., *Griselinia ruscifolia* = *Decostea ruscifolia*, Clos in Fl. Chil., *Baccharis magellanica*, Pers. (in fruit), *Pernettya empetri-*

folia, Gaud., and *P. pumila*, Hook. f., *Desfontainea spinosa*, Ruiz & Pav. (with flowers only partially withered), *Mitraria coccinea*, Cav. (in full fruit), *Dacrydium Foncki* (Phil., sub *Lepidothamnio*), *Libocedrus tetragona*, Endl., *Podocarpus nubigena*, Lindl., apparently about the southern limit of this curious species, *Phylesia buxifolia*, Lam., *Rostkovia grandiflora*, Hook. f , and *Elynanthus laxus*, Benth. & Hook. f. Gen. Pl. = *Chætospora laxa*, Hook. f. = *Chætospora rhyncosporoides*, Steud. = *Carpha paniculata*, Phil. This was first described by Sir Joseph Hooker in the 'Flora Antarctica' from a specimen collected by Darwin at Cape Tres Montes; and a second species, *Chætospora antarctica*, is described and figured in the same work from a specimen, also collected by Darwin above Cape Tres Montes. This latter appears to be a mountain variety of the common species, which extends from the Cordillera de Rauco in Chili to the Channels of Patagonia, but has not been found so far south as Fuegia or the Straits of Magellan. The only grass collected was *Hierochloa antarctica*, R. Br., var. = *H. altissima*, Steud. With reference to the last-named species I may add the remark that, with the single exception of *H. teretifolia*, Steud., all the specimens of *Hierochloa* that I have seen from Chili or Magellania appear to me to be referable to *H. antarctica* of R. Brown, under which should be ranked as synonyms, or as varieties, *H. altissima*, Steud., *H. redolens*, R. S., *H. magellanica*, Hook. f., *H. utriculata*, Kunth, and *H. arenaria*, Steud. The characters drawn from the smoothness or roughness of the sheaths or leaves, and the presence or absence of hairs on the paleæ seem to be unreliable, as these vary among plants growing in the same locality, and even the relative length of the glumes varies considerably.

The forest at Eden Harbour appears to consist altogether of *Fagus betuloides*, Mirb., and the deciduous species (*F. antarctica*) was seemingly uncommon in the northern part of the Channels. It is, however, very difficult to distinguish the closely allied species *F. betuloides* and *F. Dombeyi*, and they may grow together at Eden Harbour, as they certainly do at Hale Cove, somewhat farther north in Messier's Channel.

Contributions to the History of certain Species of Conifers.

By MAXWELL T. MASTERS, M.D., F.R.S., F.L.S.

[Read 21st January, 1886.]

(PLATES II.-X.)

THE following notes are put together with a view of supplying additional information concerning various species of Coniferæ whose history has been imperfectly known or misunderstood. In compiling them I have availed myself of the resources of London Museums and Herbaria, of communications from Sir Joseph Hooker, Prof. Sargent, Mr. Syme, the late Dr. Engelmann, my lamented friend Andrew Murray, and other botanists. I have also specially studied during the last few years the mode of growth as well as very numerous fresh specimens of foliage and cones observed in or obtained from the Royal Gardens, Kew, from various nurseries and private establishments in this country, on the continent, and in the United States. To Mr. Nicholson and Mr. J. W. Reed I am also under great obligations for numerous preparations illustrative of leaf-anatomy. The observations founded on these materials will supply the basis for a communication on the general morphology of the Order, which I hope to lay before the Society on a future occasion.

The present notes refer almost exclusively to species of which I have been enabled to examine living examples in cultivation as well as dried specimens, and of which the nomenclature has from various causes become very involved. Only those references specially important for the present purpose are here cited, and no attempt has been made to give full bibliographical references or complete lists of synonyms. These have been, for the most part, frequently published in standard works and monographs that are easily accessible, and to which these notes are intended, so far as they go, to be complementary.

The accompanying illustrations are reproduced from the pages of the 'Gardeners' Chronicle,' and have been selected either for their intrinsic interest or because no other representation of the species has hitherto been published in a generally available form. The drawings have been executed, for the most part, by Mr. Worthington Smith, some from native, others from cultivated specimens.

Fig. 1.

Abies amabilis.—Cone dark purple, slightly reduced. Native specimen.

Abies amabilis, *Forbes.* (Plate II.)

Abies amabilis, *Forbes, Pinetum Woburn.* p. 125, t. 44; *Lindley and Gordon*; *Carrière*; *Engelmann in Gard. Chron.* December 4, 1880, p. 720, f. 136–141; *Veitch*; *Sargent, Report on the Forests of North America* (1884), p. 213.

Pinus amabilis, *Douglas, Comp. Bot. Mag.* ii. p. 93 (1825); *Endlicher, Parlatore, etc.*

Picea amabilis, *Loudon, Gordon, Newberry, etc.*

Pinus grandis, *Lambert* [*not Douglas*].

Abies grandis, var. densiflora, *Engelmann olim* (*Engelmann in litt.* !).

"Valley of the Fraser River, *Engelmann* and *Sargent*, and probably farther north; south along the Cascade Mountains of Washington Territory and Oregon." Fraser River, *Jeffrey* 393! Cascade Mountains, *Lyall*!

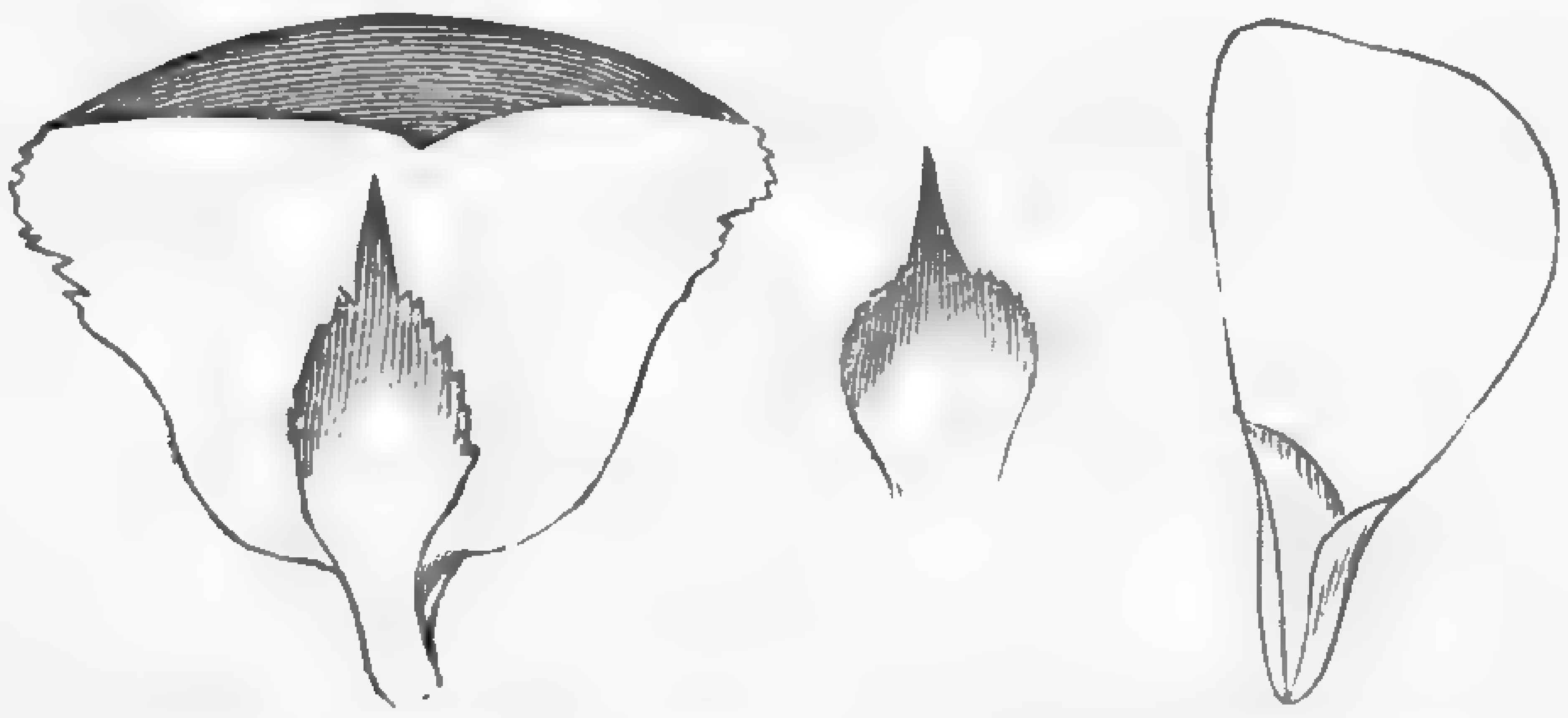
In the year 1880 Dr. Engelmann, accompanied by Prof. Sargent and Dr. Parry, ascended Silver Mountain near Fort Hope, Fraser River, and discovered at an altitude of 4000–5000 feet a Fir which they recognized to be the *Pinus amabilis* which Douglas had first made known fifty-five years previously, but the identity of which had become confused. A few weeks after, Prof. Sargent ascended the very mountain, just south of the Cascades of the Colombia, where Douglas originally discovered the plant. Dr. Engelmann thus describes the tree:—

"It is a magnificent tree, at about 4000 feet altitude; the largest specimen, growing on the banks of a mountain-torrent, was probably 150 to 200 feet high, with a trunk about 4 feet in diameter, branching to the ground and forming a perfect cone of dark green foliage. The bark of the old tree is $1\frac{1}{2}$ to 2 inches thick, furrowed and reddish grey; that of younger trees, less than 100 years old, is quite thin and smooth, light grey or almost white. It certainly is very closely allied to *A. grandis*, but is readily distinguished by its very crowded darker green foliage and its large dark purple cones. The technical characters are the following:—

"Leaves densely crowded, dark green, channelled, and without stomata above, keeled, and with two white bands below, slightly notched on the lateral and sterile branches, acute on the leaders and on the cone-bearing branches (these acute leaves often with a few stomata on the upper side towards the tip) (fig. 1); resin-ducts close to the epidermis of the lower side. Cones

deep purple, 4 and sometimes 5 inches long, 2 to $2\frac{1}{4}$ inches in diameter, slightly tapering to a retuse tip; scales in $\frac{2}{3}\frac{1}{4}$ order, not much broader than high, their bracts often more than half as long as the scale, obovate, abruptly acuminate, deep purple upwards. Wings of seeds obliquely cuneate, as long as wide, or longer (fig. 2).

Fig. 2.



Abies amabilis.—Bract, scale, and seed. (From a sketch by Dr. Engelmann.)

"*A. grandis*, which is common on the low lands along the rivers in Oregon, Washington Territory, and the southern parts of British Columbia, and abnormally ascends, has lighter-coloured, usually longer, and always less crowded (distichous, with 2–4 ranks of shorter leaves on the upper side of the branchlets), also without stomata above, more deeply emarginate on the branches, obtuse or very shortly cuspidate on the fertile branchlets, acute or acuminate only on the leaders; cones 3–4 inches long, $1\frac{1}{2}$ inch, or scarcely more, in diameter, apple-green, and usually less resinous; scales much broader than high, their bracts about one third the length of the scale, obcordate or retuse mucronate, light green; wings of seeds hatchet-shaped, wider than long.

"*A. amabilis* has the purple cones and sharp-pointed leaves (on fertile branches) of *A. subalpina*; but this latter has not such crowded leaves, much smaller cones, and is especially distinguished by the parenchymatous resin-ducts. *A. subalpina*, common in the Rocky Mountains, has been found also in Oregon (probably only east of the Cascades) and northward, but we have not as yet met with it here.

"We send a photograph of a cone-bearing branch (woodcut, fig. 1), and slightly smaller than natural, one of a sterile branch of an old tree (Pl. II.); on the latter may be seen the crowded arrangement of the leaves; on the former the shape of the cone and the sharp-pointed leaves at its bases. It will thus appear that Lambert's figure of the cone-scale and bract of his *Abies*

grandis, though a little exaggerated, is in the main correct, especially as to the long abruptly acuminate bract, the figure of which has given rise to the confusion with the Californian *A. magnifica*."—G. ENGELMANN.

To these remarks of Dr. Engelmann we may add a few notes concerning the *amabilis* generally cultivated in this country :—

Habit as of *A. Nordmanniana.*

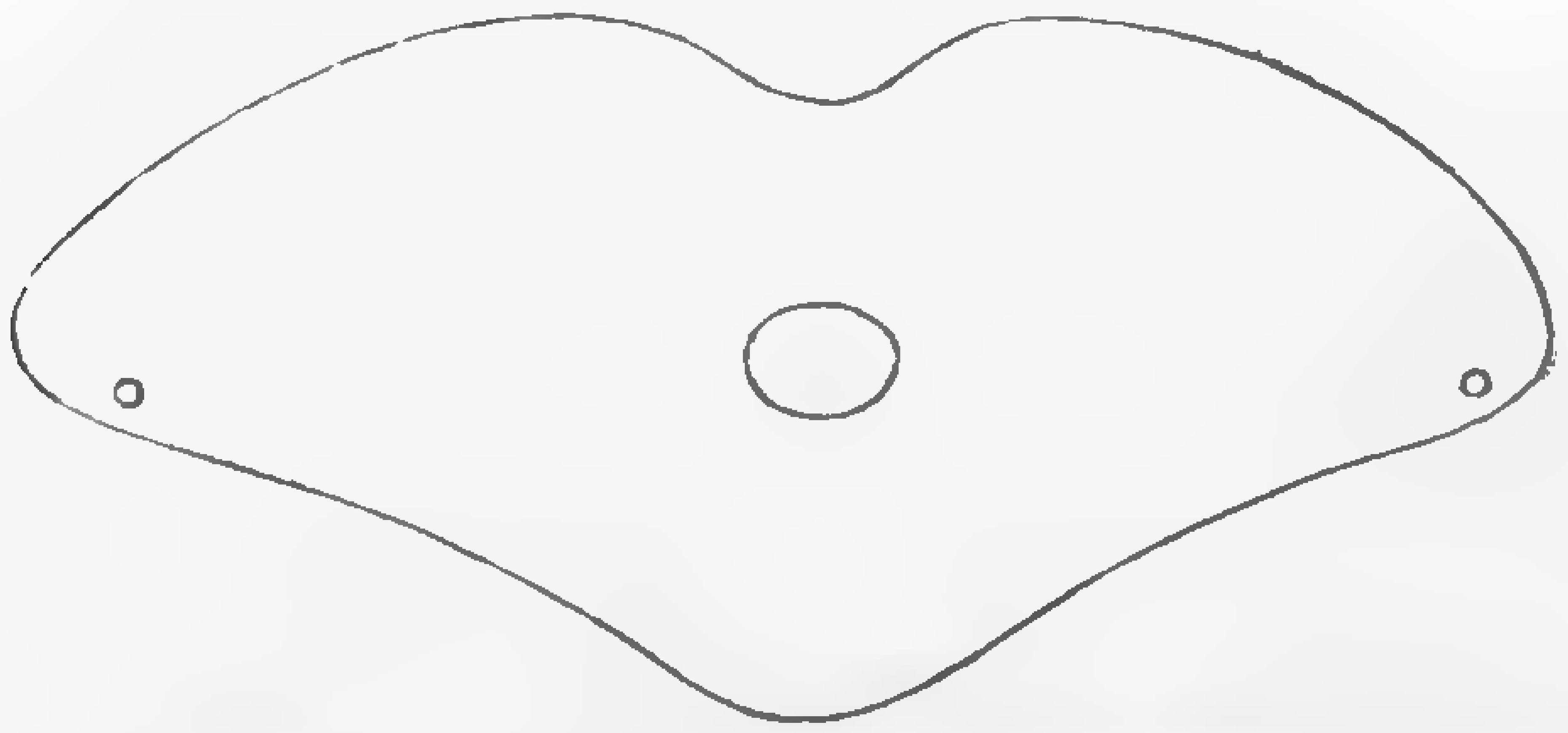
Buds small, ovoid, conic ; scales shining.

Young lateral shoots horizontal, flattish, or with a slight upward convexity, oblong obtuse in outline.

Branches smoky brown or olive-grey, slightly hirtellous or glabrous, marked with circular leaf-scars ; shoots given off nearly at right angles.

Leaves very fragrant, on the sterile branches densely crowded, in many rows all of about the same length (10–12 lines), those on the leader-shoot appressed, straight, with the white surface outer-

Fig. 3.



Abies amabilis.—Outline of leaf-section magnified, showing the position of the resin-canals in a fresh specimen. (From a sketch by Dr. Engelmann.)

most ; leaves on the lateral branches given off at an angle of 60°–80°, all turned to one side, the uppermost appressed and parallel to the long axis of the shoot, which they completely conceal, the lowermost rather longer and diverging so as to expose the brownish bark, all linear obtuse, notched at the apex or, in the case of the smaller more crowded ones at the base of the shoots, pointed, dark shining green above, furrowed in the centre, and with few or no stomata ; lower surface with a prominent midrib, and with a glaucous band with about six rows of stomata on either side between it and the green recurved margins. On transverse section the leaves have a somewhat oblong obtuse figure depressed in the middle above, prominent beneath. The hypoderm or strengthening cells are continuous throughout, the palissade cells

well marked, the resin-canals subepidermal and surrounded by strengthening cells continuous with the lower hypodermal cells; the central fibro-vascular bundle is double (fig. 3).

Abies grandis, *Lindl.* (Plate III.)

Abies grandis, *Lindley in Penny Cyclopædia*, i. p. 30; *Engelmann in Bot. Californ.* ii. p. 118; *Sargent, Forest Trees of North America*, p. 212; *Masters in Gard. Chron.* Feb. 5, 1881, p. 179, f. 33–36; *Veitch, Manual*, p. 97, f. 23, 24, *aliorumque.*

Pinus grandis, *Douglas, Endlicher, McNab, alior.*

Picea grandis, *Loudon, Murray in Gard. Chron.* July 31, 1875, p. 135, f. 28.

Abies Gordoniana, *Carrière, Bertrand.*

A. amabilis, *Murray, non alior.*

Picea lasiocarpa, *Balfour, not Hook., fide Barron in Gard. Chron.* vol. v. 1876, p. 78.

"Vancouver's Island south to Mendocino County, California, near the coast; interior valleys of Western Washington Territory and Oregon south of the Umpqua River, Cascade Mountains below

Fig. 4.

Bract, scale, and seed of *Abies grandis.*

Bracts of *Abies grandis* to show their variability.

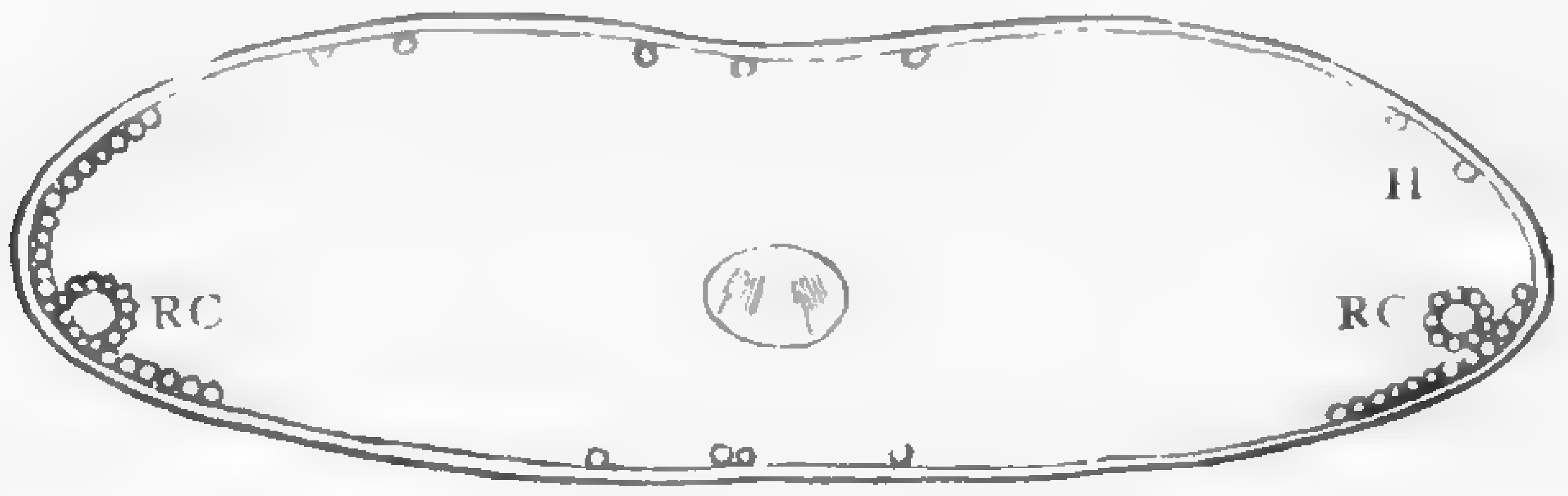
4000 feet elevation, through the Blue Mountains of Oregon to the eastern slope of the Cour d'Alêne Mountains, the Bitter-root Mountains, Idaho, and the western slopes of the Rocky Mountains of Northern Montana," *Sargent, l. c.* Columbia River and Cascade Mountains, *Lyall*! San Juan Island, *Lyall*!

In cultivation *A. grandis* varies in the length and colour of the leaves, some of the forms having received distinct names, such as *Gordoniana* &c., but these are hardly worth keeping up.

As seen in gardens *grandis* forms an elegant tree of elongated pyramidal form, the branches slender, arranged in irregular verticils, and diminishing in length gradually towards the top of the

tree, which thus forms an elongated pyramid. The shoots spread horizontally are elongate oblong, flat, with a tendency to produce a few lateral buds at irregular intervals. The bark of the young shoots is olive-brown, glabrous or hirtellous; the buds small, cylindric, elongated, ovoid-conical, rather blunt at the apex, not globose as in *concolor*. The scales are oblong-obtuse, dark brown, covered with a thin film of whitish resin. The leaves are apparently nearly distichous, spreading nearly at a right angle in one flat horizontal plane. Both the upper and lower leaves of the

Fig. 5.



Plan of section of leaf, magnified, of *Abies grandis*. RC, resin-canals.

horizontal branches are twisted at the base and leave the shoot exposed on both sides, very dark green above, with few or no stomata, but with a central groove, white beneath, and with five or seven rows of stomata on each side of the midrib, linear oblong obtuse, channelled on the upper surface and notched at the point. The leaves on the upper surface of the lateral branches are about half the length of those immediately beneath them.

The greenish-brown cones are figured on Plate III.

Var. Lowiana, *Mast.*=Picea Lowiana, *Gordon, Pinetum Supplement* (1862), p. 75; *Pinetum*, ed. 2 (1875), p. 218.

Abies Lowiana, *McNab in Gard. Chron.* 1876, v. p. 78.

Pinus Lowiana, *McNab, Proc. R. Irish Acad.* 2 ser. vol. ii. p. 680, t. 46, fig. 5, folior. anat.

Picea Parsonsiana, *Barron, Catalogue*, 1859; *Gard. Chron.* 1876, v. p. 77; *Parsons in Gard. Chron.* 1876, Jan. 8, p. 45 (*extract from 'American Gardeners' Monthly'*).

Abies Parsonsiana, *quorundam*.

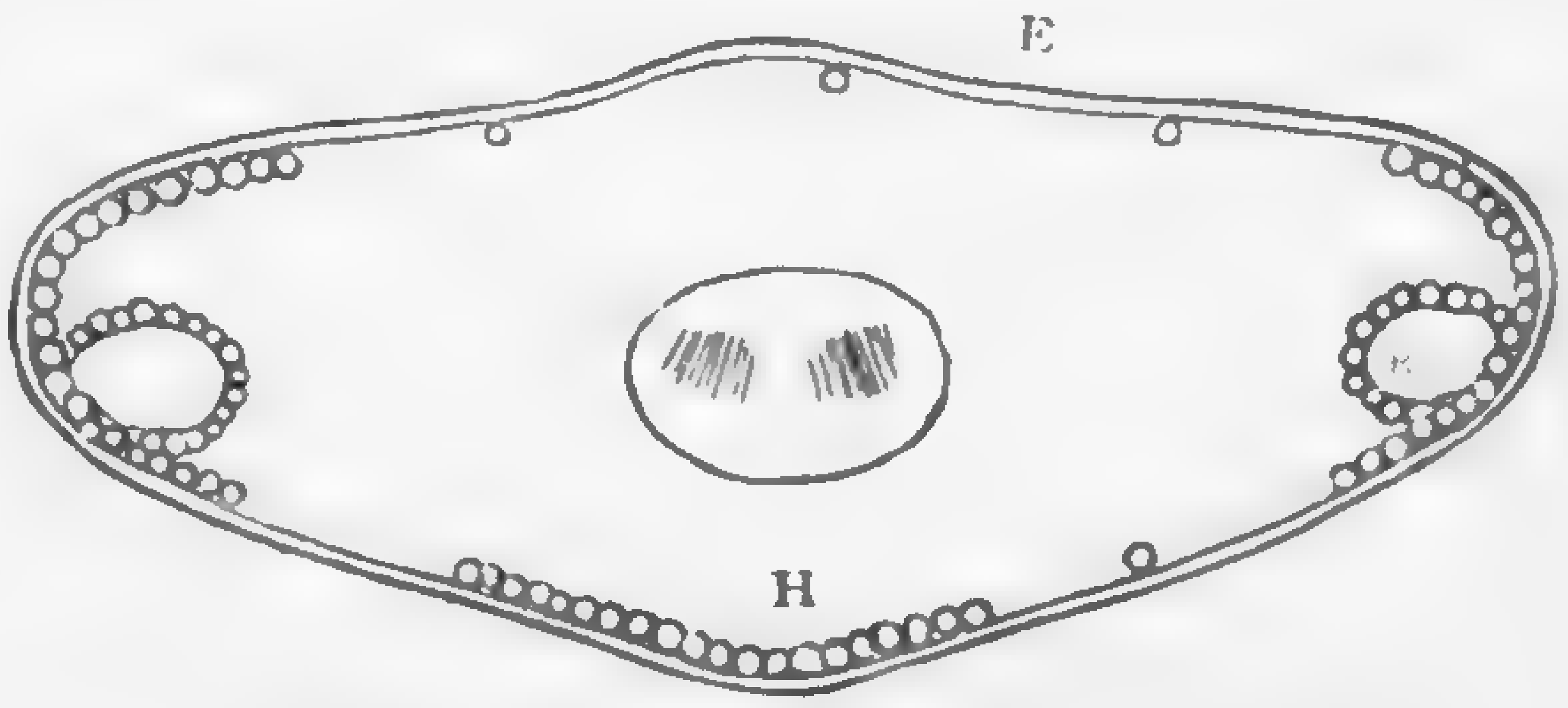
Picea *seu* Abies lasiocarpa, *hort. var., non Balfour nec Hook.*

Originally introduced from British Columbia by *Jeffrey* in 1851 (fide W. R. McNab), and from California by *Lobb* in 1855. California, Calaveros, Upper Sacramento, alt. 4000 ft., and Silver Mount Pass, *Hooker and Gray*!

In *A. grandis*, var. *Lowiana*, the habit is generally rigid; the branches more formally and closely verticillate than in *A. grandis* proper; the branches relatively stouter, shorter, and diminishing in length upwards more abruptly, so that the general outline is more bluntly pyramidal. The young shoots are flat, olive-green or brownish, shining. Buds elongate ovoid, obtuse or pyramidal; scales rounded, brown, more or less resinous. The leaves are dark green, linear oblong, blunt (not notched at the point), in few rows (apparently only in two rows), relatively very long, generally all nearly of the same length, thinly set so as to expose the shoot, and spreading horizontally in a flat plane, sometimes upturned, and given off nearly at a right angle (fig. 6). Stomata exist on both surfaces. Even in accidental cases, where the leaves are contracted in size owing to some check to growth, they are all nearly of the same length, unlike those of the typical *A. grandis*.

Fig. 6.

Abies grandis, var. *Lowiana*, cultivated specimen, to show foliage.



Plan of section of leaf, magnified, of *A. grandis*, var. *Lowiana*.

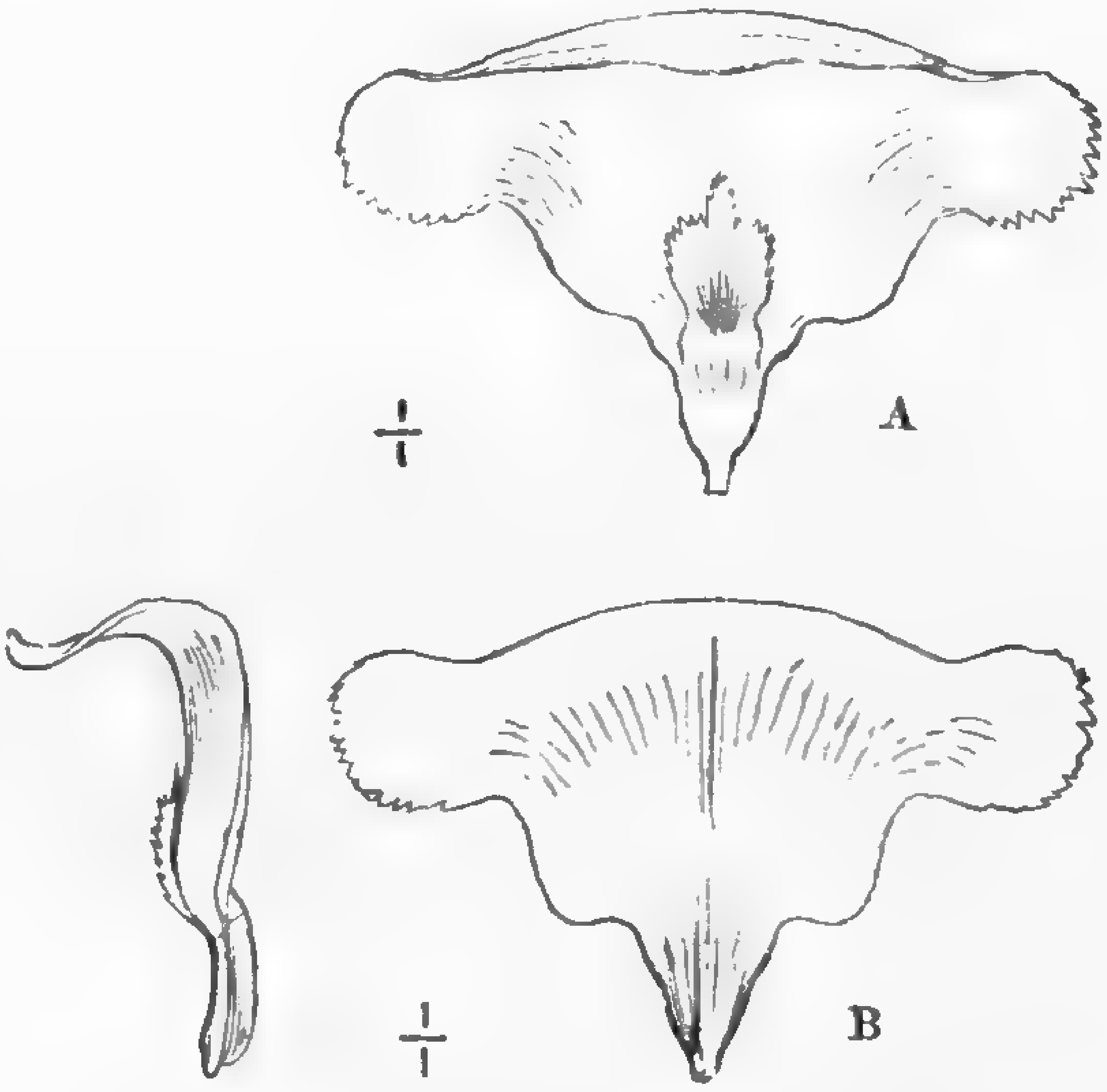
Var. PALLIDA, *Mast.* ? = A. concolor, *Engelmann* (partly). Leaves of unequal length, flat, pale in colour.

A short-leaved form raised from Californian seed, and running into *A. grandis*, var. *Lowiana*, and *A. concolor*.

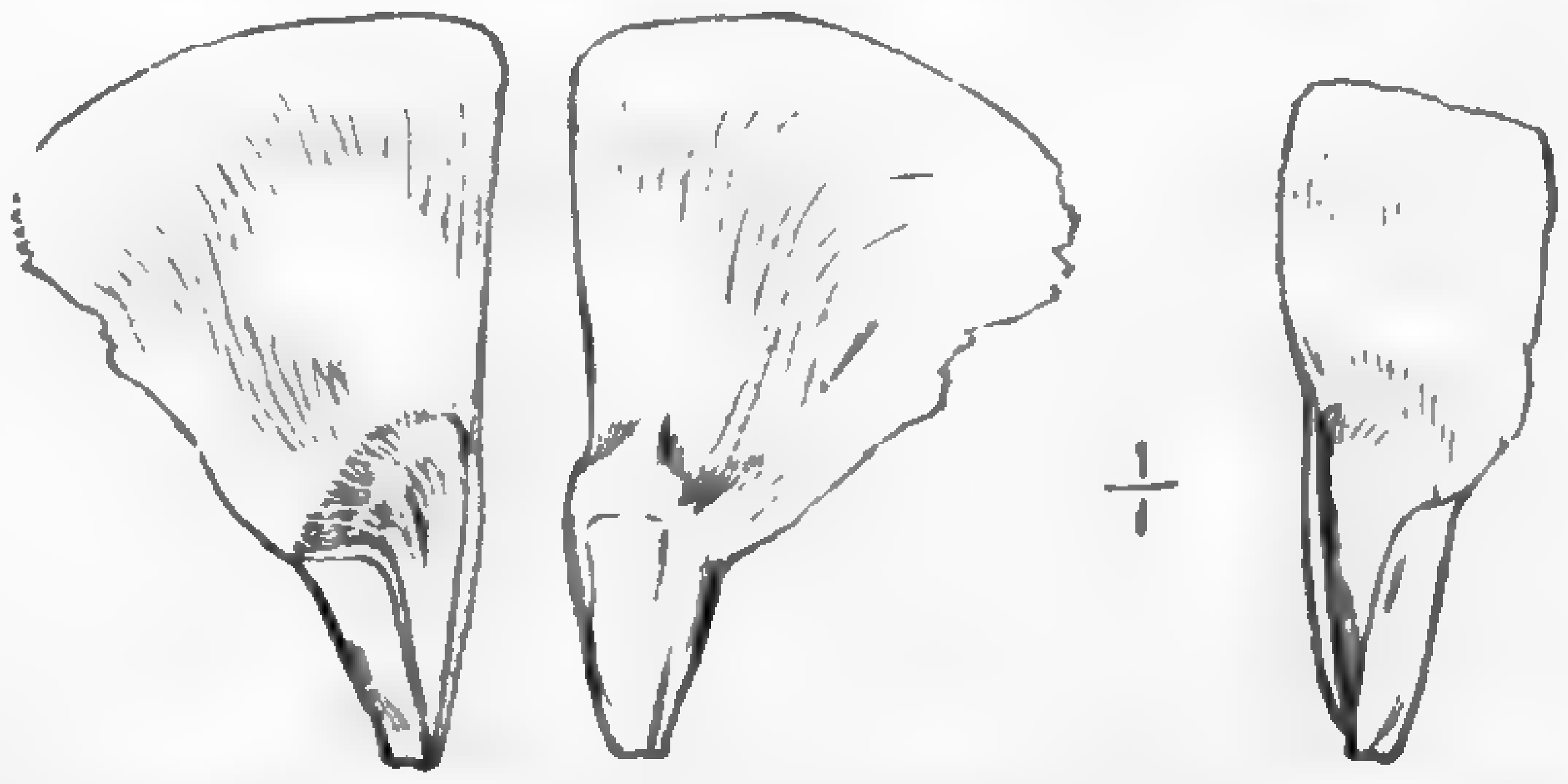
California, *Low* 3 [? *Lobb*], with which latter it was identified by Dr. Engelmann (in herb. Kew); Upper Sacramento, *Hooker and Gray*!

Most of the garden plants named *concolor* are probably seedling varieties of the Northern Californian type above mentioned, and not of the South Californian and Colorado form, though of late years the true *concolor* has been introduced from New Mexico by Roezl.

Fig. 7.



(A) bract, and (B) scale of cultivated specimen of *Abies grandis*, var. *Lowiana*.



Imperfect seeds of *A. grandis*, var. *Lowiana*.

Abies concolor, *Lindl.*

Abies concolor, *Lindley et Gordon, in Journ. Hort. Soc. Lond.* (1850) vol. v. p 210; *Engelmann, partly*; *Sargent, Report*, p. 212, *partly*; *Murray, in Gard. Chron.* 1875, p. 105. *Coulter, Botany Rocky Mts.* (1885) p. 430.

Pinus concolor, *Engelmann ex Parlatore, in DC. Prod.* xvi. ii. (1868) p. 427; *McNab, in Proc. R. Irish Acad.* ser. 2, vol. ii. p. 681 (1876).

Picea concolor, *Gordon, Pinetum*, ed. 2, p. 216.

Picea concolor violacea, *Roezl, Gard. Chron.* vol. xii. (1879) p. 684, *et in herb. prop.*

Santa Fé Mountains, New Mexico, *Fendler* 828!; *Roezl*!; Rio de los Animos, South California, *Engelmann, G. R. Vasey*!;

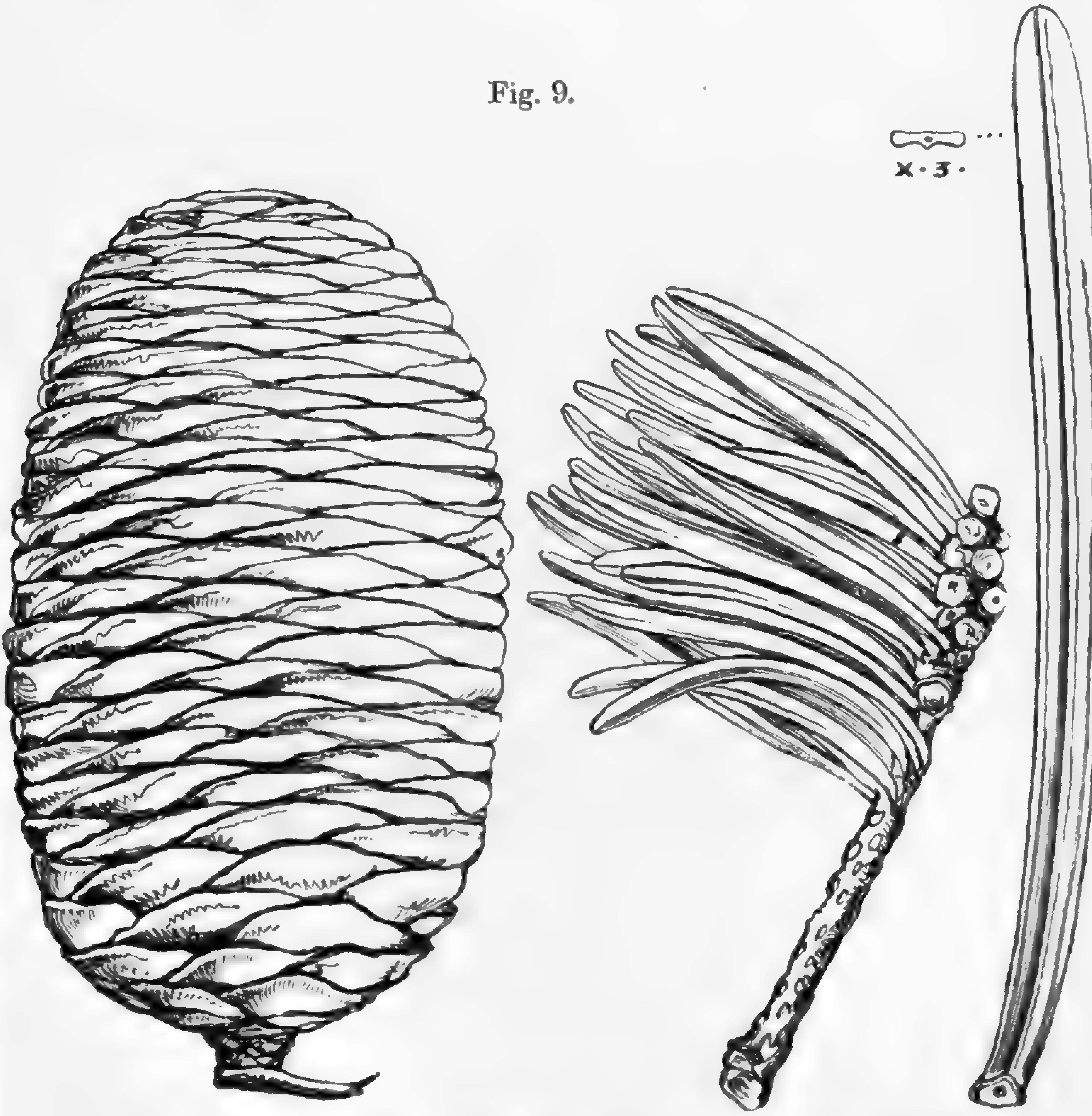
foot hills of Pike's Peak, Cañon, at Glen Eyrie, Colorado, *Engelmann*!, *Hooker and Gray*!; mountains of Southern Colorado,

Fig. 8.

Bracts of *A. concolor*. (After A. Murray.)

Brandegee!; Manitou, *Hooker and Gray*!; Plumas county, California, *Mrs. Austen* 133!

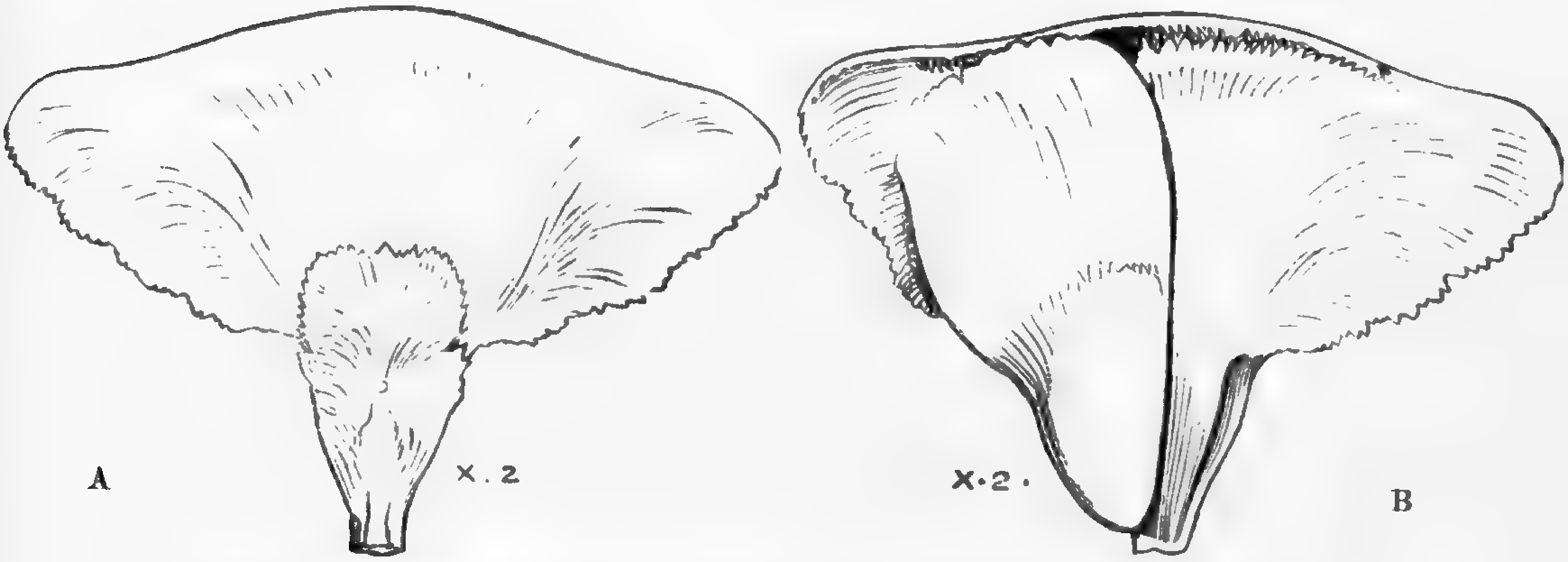
Fig. 9.



Abies concolor.—Cone, foliage, leaf, and section of native specimen collected by Roezl.

If this be not a species, it is an exceedingly well-marked variety, owing its peculiarities to climatal and geographical influences, as pointed out by the late Mr. Murray.

Fig. 10.



A. Bract and scale of *Abies concolor*, from the back; B, scale with seed.

In *A. concolor* (true) the young shoots are grey, hoary, yellowish or olive-green. The buds (fig. 11) are rounded or dome-shaped, pale-coloured, larger than in the chestnut-brown conoid or pyramidal buds of *A. grandis*, var. *Lowiana*, often very prominent; scales oblong obtuse. In addition to the terminal buds, others appear at irregular intervals on the side shoots. The leaves are in many ranks, thinly set, so that the shoot is exposed, more or less upturned (fig. 9), all of about equal length, concolorous and stomatiferous on both surfaces. As compared with the leaves of *A. grandis*, var. *Lowiana* (fig. 6), they are less regularly arranged, in more numerous planes, they are given off from the branch at a more acute angle, and are usually paler, narrower, and more sharply pointed.

The majority of the plants cultivated as *A. concolor* have the leaves more nearly resembling those of *A. grandis*, var. *Lowiana*, and many of them may be included under my variety *pallida*. The extreme forms may be considered as geographical varieties. In any case, it is quite certain that great variation exists among the seedlings in the same seed-bed. Supposing external circumstances to remain unchanged, much of this early variation may, and probably will, disappear as the plants grow older; but it is easy to see how some of these forms may be better adapted for certain conditions than others, and how they might in that case be perpetuated.

Fig. 11.

Abies concolor (true). Foliage and buds of cultivated examples.

Great difference of opinion exists, as will be apparent from what has been already said, as to the identity and specific limitations of the plants variously included under the names *grandis*, *Gordoniana*, *lasiocarpa*, *Lowiana*, *Parsonsiana*, and *concolor*. For the purpose of this communication, and with a view to facilitate the discrimination of specimens, I have considered the tree found in Colorado, Utah, and South California to represent the true *Abies concolor*, which differs in various particulars, especially in the leaves and buds, from *A. grandis*, or *A. grandis*,

var. *Lowiana*. Engelmann and Sargent, however, from their examination of the trees in their native forests, combine with *A. concolor* the tree found on the Californian Sierras, and variously known in gardens as *Lowiana*, *Parsonsiana*, or *lasiocarpa* (not of Hooker). This is usually very different from *concolor* proper, although in nursery seed-beds it is true that the various forms run so much one into the other that, while it is easy to pick out the extreme forms, the intermediate forms defy precise differentiation in the young state.

Professor Sargent and Dr. Engelmann, as already remarked, consider the Colorado and the Californian trees to be specifically identical. The former author, in his 'Forest Trees of North America' (1884), p. 213, gives the range of the species, as he understands it, as follows:—"Northern slopes of the Siskiyou Mountains, Oregon, and perhaps further north in the Cascade Mountains, south along the western slope of the Sierra Nevadas to the San Bernardino and San Jacinto Mountains, California, along the high mountains of Northern Arizona to the Mogollon Mountains, New Mexico, northwards to the Pike region of Colorado, and in the Wahsatch Mountains of Utah."

Prof. Sargent also says of it, "Perhaps merely a southern form of the too nearly allied *A. grandis*, Lindley."

Andrew Murray also considered *A. concolor* to be only a form of *grandis*, and arrived at this conclusion after having seen *grandis* growing on the Rocky Mountains. "The characters," he writes in Gard. Chron. April 1875, p. 465, "which were supposed to differentiate it [*concolor*] from *grandis* were its white colour, the same on both sides of the leaf, its somewhat falcate form, and some supposed difference in the bract. The former are . . . . . common attributes of *P. grandis* in Utah, where the hoary hue of the vegetation of the plains extends also into the mountains; and as to the more erect altitude and slightly bent leaf, the variation is very slight, and occurs also in *P. grandis*. The [cone and] the bract also in no respect differ from those of *P. grandis* . . . . . "

In Utah, Murray continues, the colour of the foliage "seemed to depend a good deal upon the nature of the place, whether near a stream or barren and exposed, the more barren the more white . . . . . There were, in fact, very great differences in the habit of trees of *P. grandis* growing side by side, especially when young. One would bear its leaves scattered thinly and sparingly

and wide apart; another would have its foliage twice as thick: one would have long leaves, as in *Lowiana*, another quite near it would have them only half the length; and even in colour a great difference was constantly to be seen—one would be of a darker green, another yellowish-olive, a third nearly white, and so on."

Sargent, writing in the Gard. Chron. January 2, 1886, says:—"*A. grandis*, as it grows in Vancouver's Island, looks certainly different enough from *A. concolor* of Southern Colorado; but there are no real characters to distinguish them, except the length of the leaves and the number and position of the stomata, not very valuable or constant indications. The cones and the leaf-structure of the two species are identical, their bark does not differ more than might be expected in individuals of the same species scattered over such an immense territory and subjected to such different climatic influences. I have traced this species, or these species, from Vancouver's Island, inland at the north to the extreme eastern limits of their distribution in that direction, the western base of the Rocky Mountains, and Montana. I have followed them south through Washington, Oregon, and California to Arizona and Colorado. For garden purposes it will be wise, perhaps, to keep these species separate, and even to admit *A. Lowiana*, which is only the *A. concolor* of the Californian Sierra Nevada; but, looking at the matter broadly, I am inclined to believe that these different forms—*A. grandis* at the north, *A. Lowiana* or *lasiocarpa* in California; *A. concolor* in Utah, Arizona, New Mexico, and Colorado—distinct enough in many minor respects, but not to be distinguished by essential characters, must all be referred to one species of immense geographical distribution."

Taking the broad view of species, the opinion of those best qualified to give an opinion from having seen the species in their native haunts is the more worthy of acceptance; for, however great the differences that are observable in particular instances, they are not sufficient to invalidate the probability that they may have sprung, at no very remote period relatively, from a common source.

The arrangement above proposed may, in some sort, be looked on as a compromise justifiable on the grounds of practical utility. As it will be seen, it assumes the specific distinction of *A. grandis* and of *A. concolor*, referring the long-leaved form *Lowiana*, and

some of the pale-leaved forms to *grandis*, and keeping separate the form found in New Mexico, Utah, &c.

Abies subalpina, *Englm.*

Abies subalpina, *Engelmann in Amer. Naturalist*, x. p. 554; *Synopsis Amer. Firs, Trans. Acad. St. Louis*, 1878, p. 597, *et in Gard. Chron.* Feb. 19, 1881, p. 236, f. 43, 44, 45; *Sargent, Forest Trees of North America* (1884), p. 211; *Coulter, Bot. Rocky Mts.* 1885, p. 430.

Fig. 12.

A

B

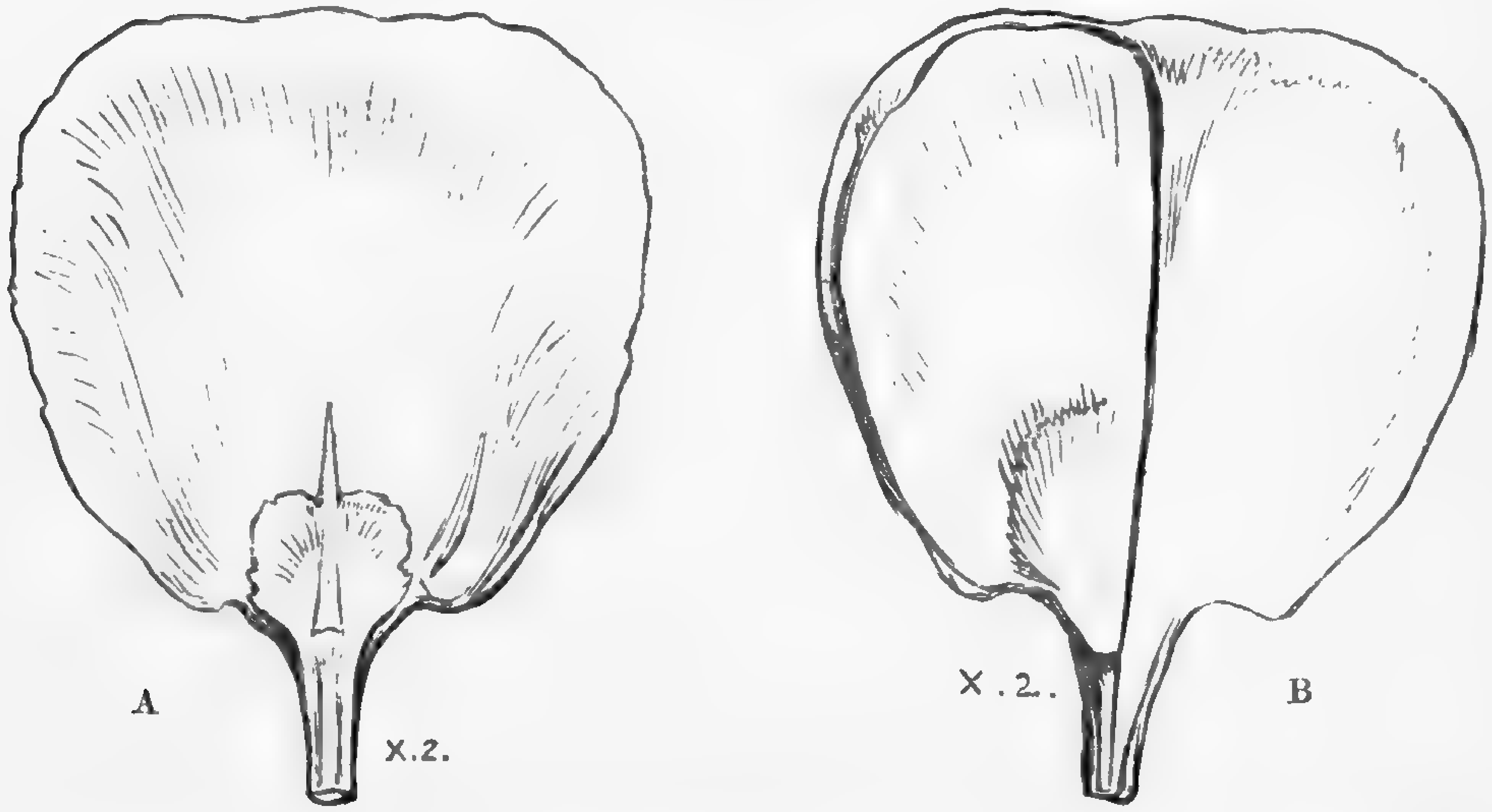
Abies subalpina, Eng. = *Picea bifolia*, A. Murr.—Native specimen.
A, cone; B, leaf and cross section.

? Pinus lasiocarpa, *Hook. Flor. Bor.-Amer.* ii. p. 163 (1840), partly; *McNab in Proc. R. Irish Acad.* ser. 2, vol. ii. (1876), p. 682, t. 46. f. 7.

Abies lasiocarpa, *Nuttall ex Sargent, l. c.* p. 211; *Lindley and Gordon, Journ. Hort. Soc. Lond.* (1850), v. p. 210.

Picea amabilis, *Gordon, Pinetum,* ed. 2, p. 213, partly.

Fig. 13.



A. Bract and seed-scale of *Abies subalpina,* from the back; B, scale and seed.

Abies bifolia, *Murray in Proc. Hort. Soc. Lond.* iii. p. 320, f. 51–56; *et in Gard. Chron.* 1875, p. 465, f. 96–97 (Picea); *McNab, l. c.* t. 47. f. 8, folior. anat.

A. grandis, *Engelmann, ex Sargent, l. c.* (*not Lindley*).

Pinus amabilis, *Parlatore in DC. Prod.* xvi. ii. p. 426, partly.

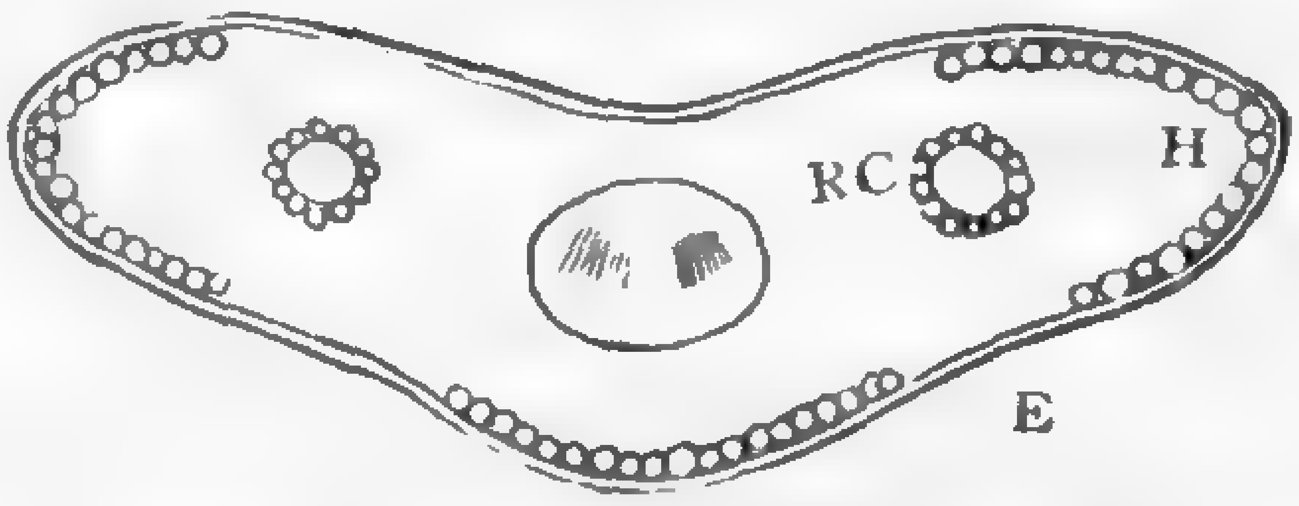
Picea bifolia, *Murray in Gard. Chron.* 1875, p. 106.

"Valley of the Stakhin River, Alaska, lat. 60° N. (*Muir*), through British Columbia and along the Cascade Mountains to Northern Oregon (*Collier*); through the Blue Mountains of Oregon and the ranges of Idaho, Montana, Wyoming, Utah, and Colorado," *Sargent, l. c.* p. 211; Cascade Mountains of Oregon, *Moseley*!; Columbia River, *Lyall*!; Galton Range at 7000 ft. *Lyall*!; east side of Cascade Mountains, lat. 49° N., not uncommon up to 6000 ft. above the sea, "Mareilp" in coll. *Lyall*!; *Pringle*!; Colorado, *Derry*!; Forest City, *Engelmann, Hooker and Gray*!, *Sargent*!

The *lasiocarpa* of Hooker's description is not easily recognizable. The leaves of the type specimen in the Kew Herbarium

are like those of *A. amabilis*; but their resin-canals (fig. 14) are parenchymatous, not subepidermal, and correspond very closely in structure with undoubted *subalpina* wild and cultivated (see woodcut, fig. 17).

Fig. 14.



A. lasiocarpa, Hook.; type. Plan of leaf-section, magnified.

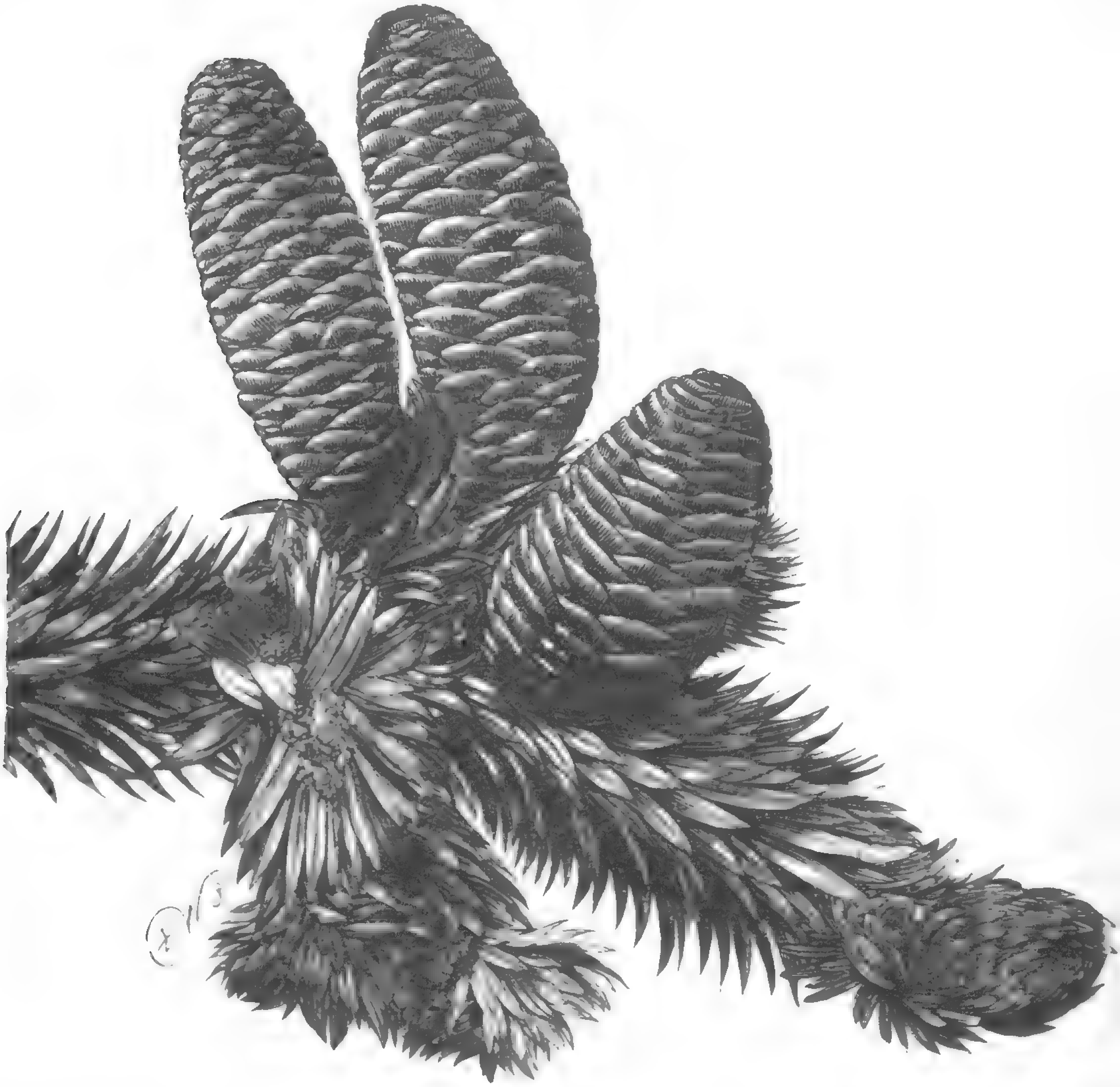
Engelmann speaks of it as the Western representative of *A. balsamea*. But for the doubt attaching to Hooker's name *lasiocarpa*, Nuttall's name of *Abies lasiocarpa* should have precedence

Fig. 15.

Leaves of *Abies subalpina*. Sterile branch.

on the ground of priority, but under the circumstances it seems preferable to adopt Engelmann's designation. In the form of the seed-scale the present species resembles *A. magnifica*. The habit of the wild plant is peculiar: the branches, often suffering periodic arrests of growth, have in consequence a contracted necklace-like appearance. The leaves on the cone-bearing branches are sharply pointed.

Fig. 16.

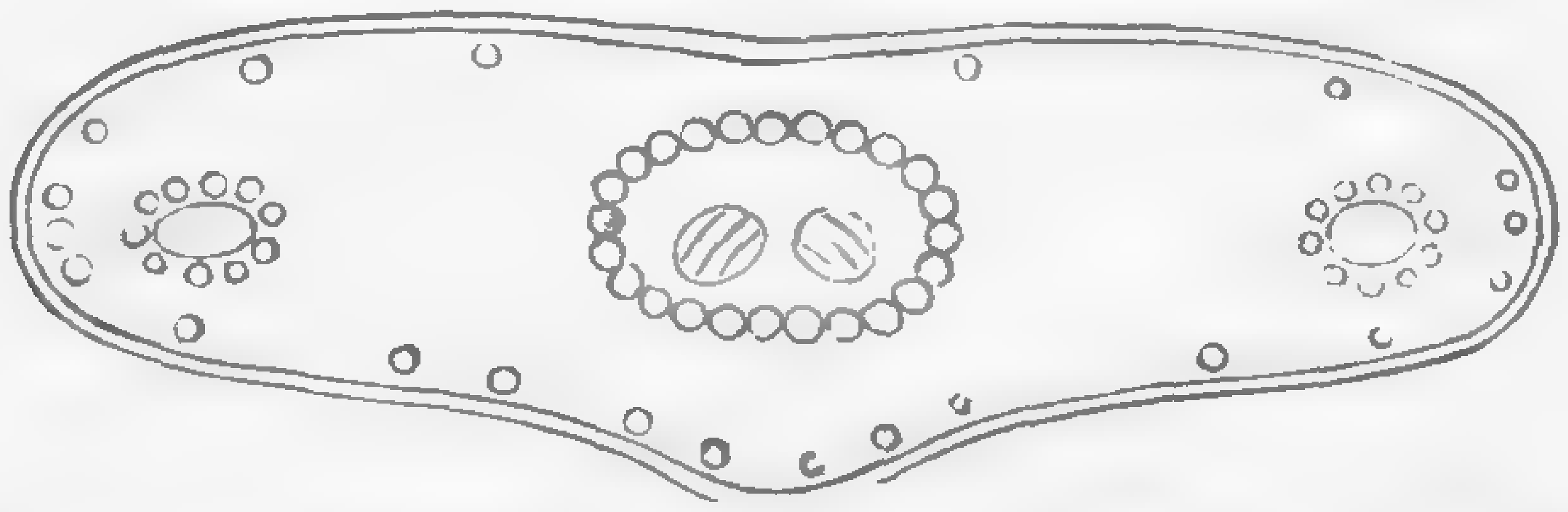


Cone-bearing branch of *Abies subalpina*. Native specimen.

In cultivation there are at present only small examples. The bark of the young branches is greyish brown, hirtellous. Buds ovoid, broadly obtuse. Scales oblong, brown, resinous. Leaves in many rows given off on all sides at an acute angle, linear

oblong, somewhat dilated near the top, subspatulate, pointed, or shortly notched, flattish and channelled on the upper, rounded on the lower surface, with a slightly prominent midrib, on each side

Fig. 17.



Plan of section of leaf of *A. subalpina*, magnified; cultivated.

of which are two glaucous bands of stomata arranged in five longitudinal series.

Abies nobilis and A. magnifica.

The confusion that has reigned as to these plants is analogous to that already mentioned in the case of *A. grandis*, &c. It is not necessary to go into the history of the matter, about which so much has already been written by different botanists, and from various points of view.

It may suffice here to say that, according to the latest views of the botanists best qualified to give an opinion (the late Dr. Engelmann and Prof. Sargent), *A. nobilis* and *A. magnifica* are to be considered distinct species. The points of distinction relied on are principally the flattish leaves of *A. nobilis*, grooved more or less on the upper surface (see Pl. IV., top fig.), as contrasted with the four-sided leaves of *A. magrifica*, in which there is no groove, but in which, on the contrary, the midrib is prominent on both surfaces (see woodcut, fig. 20). *A. nobilis* is a native of Oregon, not extending south beyond North California; while *A. magnifica* is stated not to occur in Oregon, but to extend from Mount Shasta along the western slopes of the Sierras to Kern County, lat. 33° N.

Other alleged points of difference will be alluded to later on; suffice it here to say that they are in my judgment not constant, and that although for horticultural, and probably for forestal, purposes, it may be most convenient to keep the two extremes distinct, yet the numerous variations indicate the probability of a common origin, and consequently justify the establishment of a single species or super-species, to which the name *nobilis* as the older of the two may be given. The following arrangement is therefore proposed:—

Abies nobilis, *Lindl.* (Plate IV.)

Abies nobilis, *Lindley in Penny Cyclopædia*, i. p. 30; *Engelmann in Botany of California*, ii. p. 119; *Gard. Chron.* November 29, 1879, p. 685; *Sargent, Forest Trees of North America*, p. 214; *Veitch, aliorumque.*

Pinus nobilis, *Douglas in Comp. Bot. Mag.* ii. p. 147; *Lambert*; *Hooker*; *Endlicher*; *Parlatore in DC. Prod.* xvi. ii. 419, *et alior.*; *McNab in Proc. R. Irish Acad.* ser. 2, ii. p. 699, t. 49. f. 29.

Picea nobilis, *Loudon, Gordon, Lawson, Pinetum Brit.* ii. p. 181, t. 28, 29.

Pseudotsuga nobilis, *Bertrand in Bull. Soc. Bot. France*, xviii. p. 86; *et in Ann. Sciences Nat.* sér. 5, tom. 20, p. 86.

"Oregon, Cascade Mountains from the Columbia River south to the valley of the Upper Rogue River between lat. 42° and 43° N., and along the summits of the Coast Range from the Columbia to the Nestucca river," *Sargent, l. c.*; on the High Mountains in the Grand Rapids on the Columbia and near the base of Mount Hood (1825), *Douglas* in Herb. Kew!; Cascades of the Columbia, *Dr. Gardiner*!; Cascade Mountains, *Engelmann and Sargent*!; Oregon, Mary's Peak, *Moseley* 3992 (forma strobilis minoribus)!; California, Mt. Shasta, lat. 41° 50′, alt. 6000 ft., *Jeffrey*!

A. nobilis in cultivation presents the following characteristics:—Branches verticillate. Young shoots reddish brown, hirtellous. Buds ovoid-oblong, brown, more or less resinous. Scales oblong, the lower ones pointed. Lateral shoots spreading horizontally, oblong obtuse in outline, more or less four-sided (not flat) owing to the arrangement of the leaves. Leaves densely crowded in several rows, those on the lower surface twisted at the base so as to bring them into the horizontal position, and allowing the reddish-coloured bark to be seen between their bases; those on the upper surface more or less curved, assurgent with the points directed either upwards or away from the apex of the branch, *i. e.* towards the trunk, entirely concealing the surface of the shoot, and giving it the appearance of a flat brush, the leaves representing the bristles. The typical *nobilis* may generally be recognized by its flattish, broadly linear leaves grooved on the upper surface (see Pl. IV., top fig.), either at the base only, or for the greater part of its length, with whitish bands of stomata, on the under surface only or on both. The cones are conoidal, rarely cylindric, and the bracts projecting, acuminate,

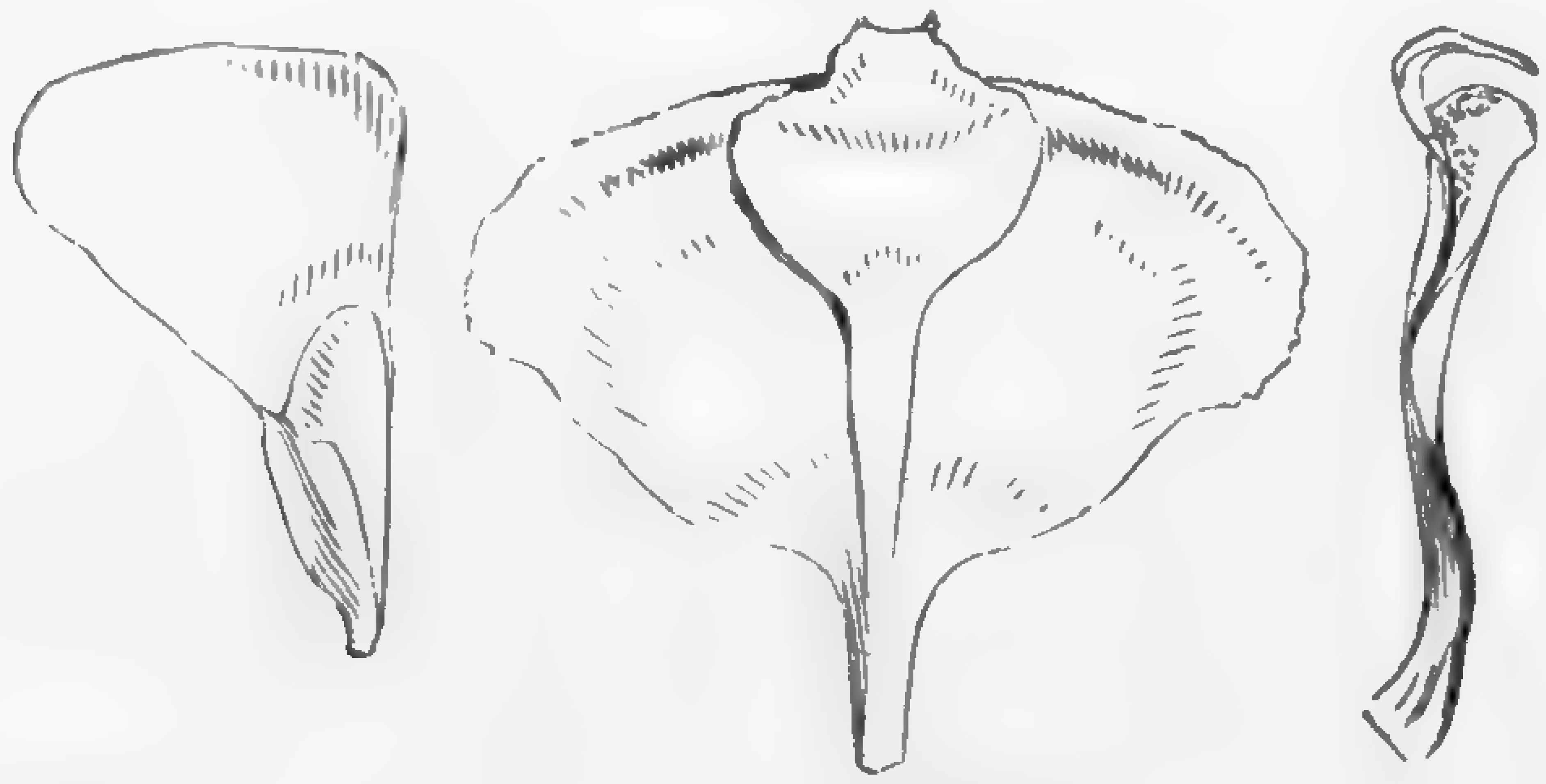
the points generally turned downwards. But even on the same tree the leaves vary, and those on robust leader-shoots and on the fertile branches often differ from those on the lateral or younger shoots. Four-sided leaves are not uncommon on the fertile branches. In the dimensions of the cone and the extent to which the bracts project there are equally great variations.

The cones are, when young, frequently of a purple colour, fading into olive-brown. Sir John Walrond informs me that the cones formerly produced on his trees in cultivation were purple, but that of late years, although "the cones maintain their size, they are of a full brown colour, though produced on the same tree."

Var. GLAUCA.

In cultivation forms of *A. nobilis* are obtained with broader, closer, and more glaucous leaves than ordinary, with the same structure as in ordinary *nobilis*. In the young state

Fig. 18.



Bract, scale, and seed of *Abies nobilis*, var. *glauca*.

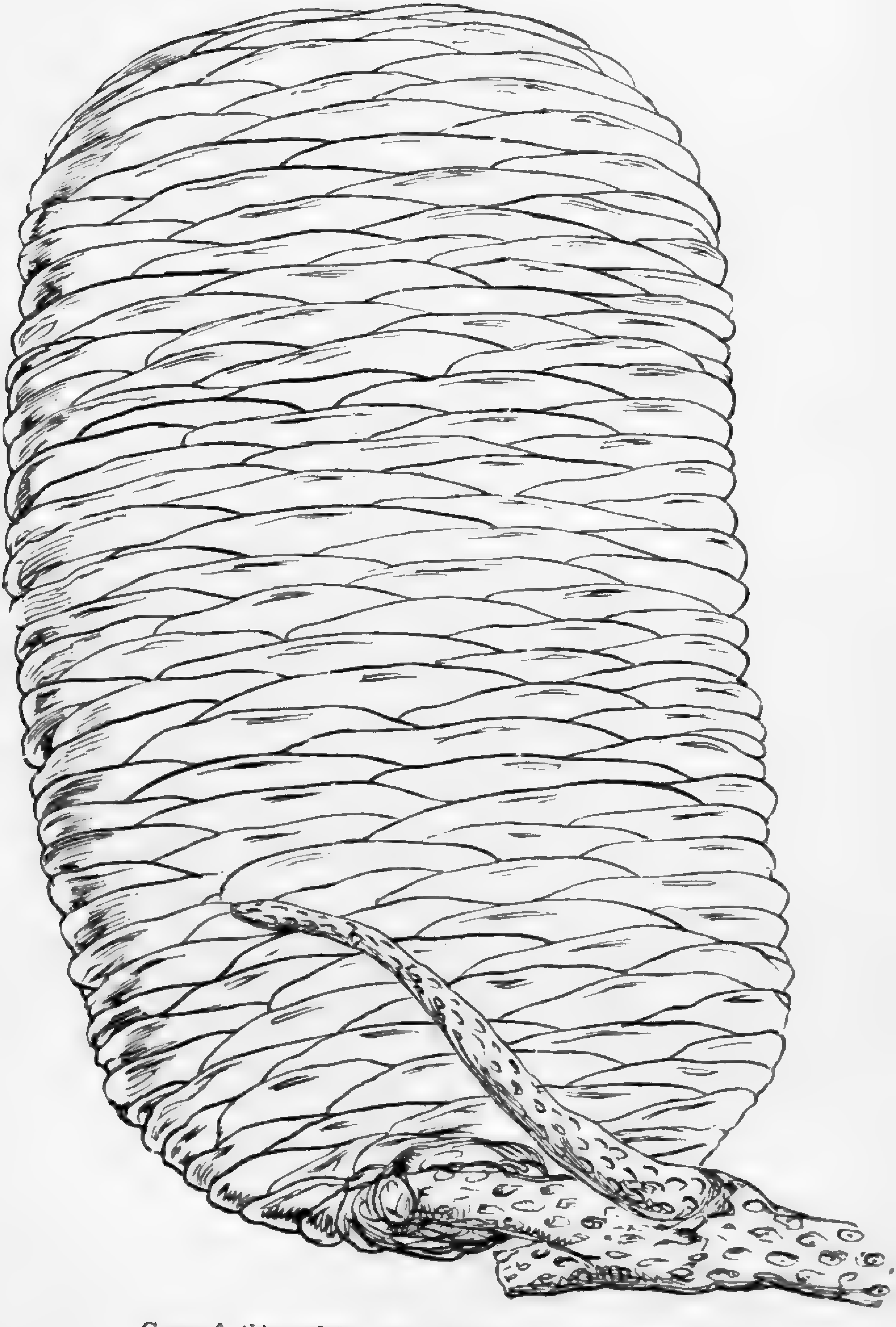
the plant is altogether handsomer than the typical *nobilis*. A cone of this variety, produced some years since in the Cranston Nursery at Hereford, was remarkable for the inflexion of the points of the bracts (see woodcut, fig. 18).

Var. MAGNIFICA. (Plate V.)

Abies magnifica, *Murray*, *Proc. Hort. Soc. Lond.* iii. (1862), p. 318, f. 42–50; *Gard. Chron.* 1875, vol. iii. p. 105, and vol. iv. n. s. p. 134; *Engelmann in Gard. Chron.* 1879, p. 685, f. 116; *in Botany of California*, ii. p. 119, *et in Coulter's Botanical Gazette*, vii. p. 4; *Veitch, Manual*; *Sargent, Forest Trees of North America*, p. 214.

A. campylocarpa, *Murray in Trans. Bot. Soc. Edinb.* vi. p. 370.

Fig. 19.



Cone of *Abies nobilis*, var. *magnifica*. Native specimen.

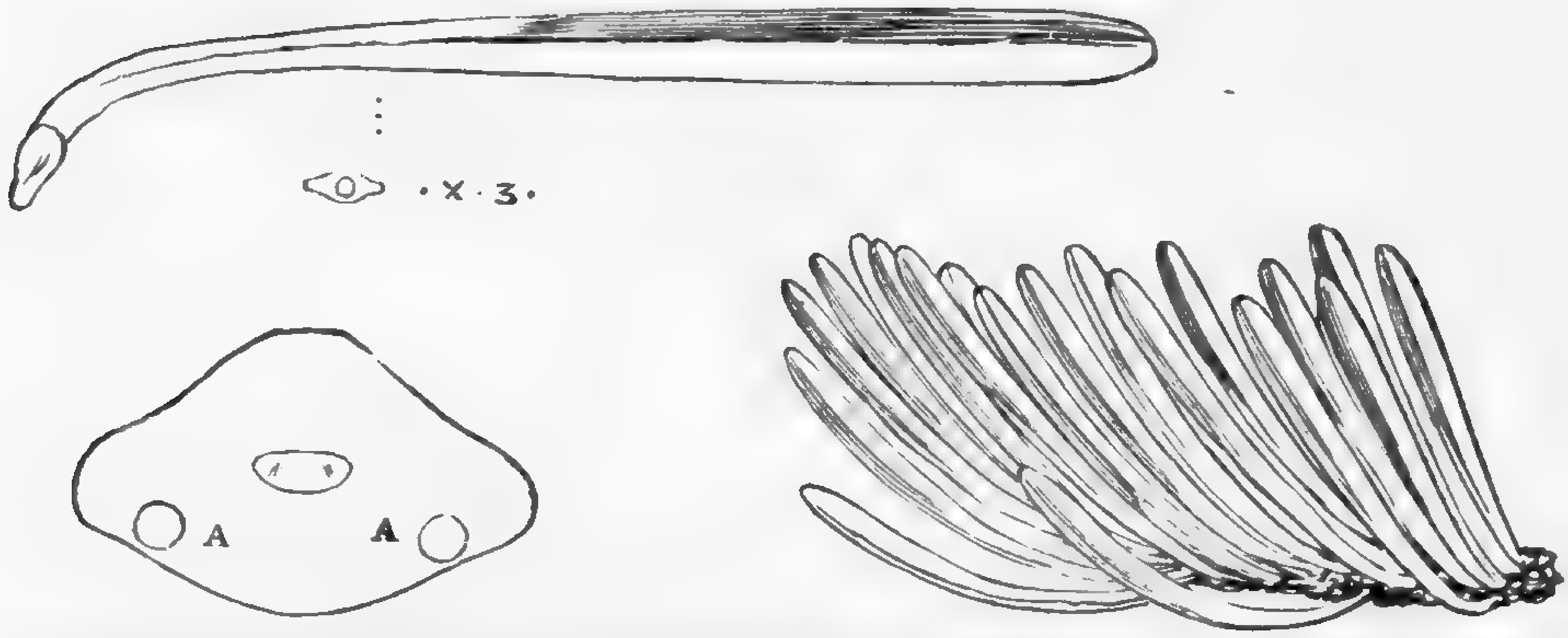
A. nobilis robusta, *Carrière, Traité*, ii. p. 269, *et hort. quorund.*

Pinus amabilis, *Parlatore in DC. Prod.* xvi. ii. 426, partly; *McNab in Proc. R. Irish Acad.* vol. ii. (1876), p. 700, t. 49. f. 30.

Pseudotsuga magnifica, *McNab in Proc. R. Irish Acad.* ser. 2, ii. p. 700, t. 49. f. 30, 30 *a* (1876).

"California, Mount Shasta, south along the western slope of the Sierra Nevadas to Kern County," *Sargent, l. c.*

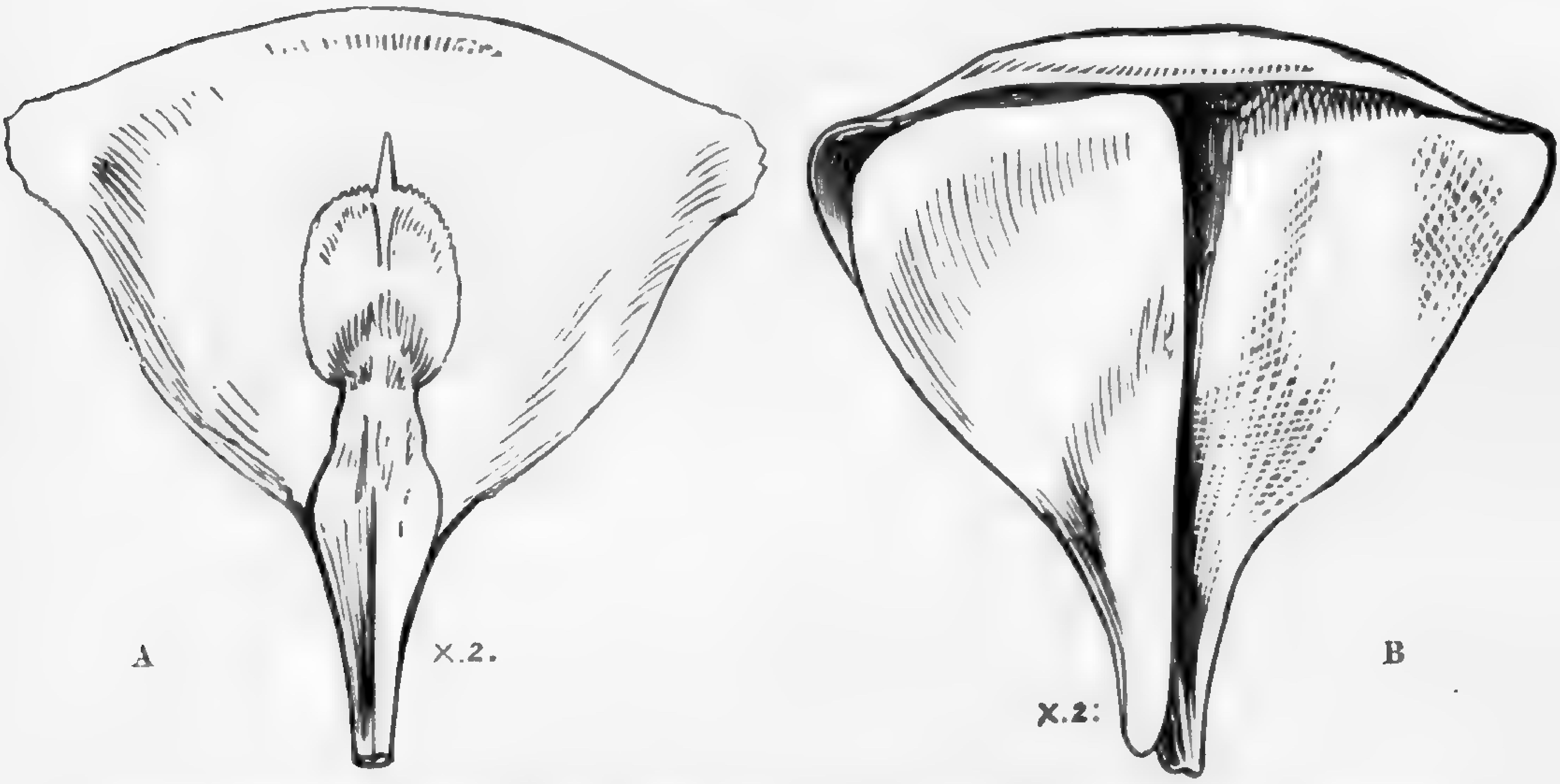
Fig. 20.



Leaves and leaf-section of *Abies nobilis*, var. *magnifica*. A, A, resin-canals.

To this variety may be referred specimens received from California, *Lobb* 441, *a, b* (1852) !, *Lemmon*; Mount Stanford, Silver Pass and Shasta, *Hooker and Gray*!; *Roezl*!; *Low*!; *Gordon* in herb.!

Fig. 21.



Seed-scales of *A. nobilis*, var. *magnifica*. A, from the back, showing the bract; and B, from the front, showing the seed. Native specimen.

In the typical *magnifica* the young shoots are elongate and brush-like as in *nobilis*, olive-brown, hirtellous. The buds are small, oblong obtuse. Scales oblong, the lower ones pointed, the leaves many-ranked, upturned, longer, deflexed, assurgent, and with their points often directed towards the apex of the branch away from the trunk, straighter and more slender than in *nobilis*, four-sided and pointed, generally not at all grooved but sometimes slightly so at the base. The leaves on the older and on the cone-bearing shoots are often much shorter, stouter, and more abruptly curved than in faster growing shoots. The cones are blunt, usually less tapering than in *nobilis*, and the bracts usually so much shorter than the scales that they are completely concealed by them. The scales of *magnifica* are, moreover, very broad and deep, transversely oval with a long wedge-like stalk (see woodcut, fig. 21). In *nobilis* the scales are usually smaller, not so deep, more angular in outline, and with a relatively shorter stalk (woodcut, fig. 18, p. 189, and Plate IV. B).

The *nobilis robusta* of Carrière, and of some English gardens, is, I believe, identical with, or a mere form of, *magnifica*.

It may be well here to quote Carrière's description of *Abies nobilis robusta*, which agrees well with the *magnifica* of English gardens :—

"ABIES NOBILIS ROBUSTA, *Veitch*.
Abies amabilis, *hort. non Forbes*.
Picea amabilis magnifica, *hort*.
Picea amabilis, *hort. angl*.
Picea magnifica, *hort*.
Picea amabilis robusta, *hort. aliq*.
Abies magnifica, *hort. aliq*.

"Cette forme, que l'on trouve aujourd'hui dans le commerce sous le nom d'*Abies amabilis*, présente les caractères suivants :—Branches verticillées, rapprochées, très-étalées. Ramules et ramilles distiques. Feuilles très-nombreuses, se retournant vers le dessus des branches qu'elles cachent à peu près complétement, étroites, parfois subtétragones ou rhomboïdales, ordinairement falquées, un peu contournées et relevées au sommet. Puis, lorsque les arbres vieillissent, ces feuilles deviennent plus larges en se régularisant, et les arbres, alors, ont beaucoup plus de ressemblance avec

l'*A. nobilis.* Du reste ces plantes paraissent très-variables, de sorte que, dans un semis, on pourrait facilement en faire plusieurs variétés très-distinctes, mais qui, peut-être, perdraient peu à peu leurs caractères exceptionnels. Néanmoins l'*A. nobilis robusta*, beaucoup plus facile à élever que l'*A. nobilis*, est bien préférable à celui-ci; aussi tend-il à le remplacer."

The *magnifica* of English gardens agrees with this description, and is noticeable for its robust habit and formal whorls. The leaves on the leading shoot are appressed spirally around the stem, and often stouter than those on the lateral branches.

A. magnifica and *A. nobilis robusta* of gardens (for without cones they cannot be separated) differ in habit from *A. nobilis*, being much more formal and rigid in the mode of growth; the branches are more nearly of equal length, and the leaves on the sterile branches longer, straighter, and more slender than in *nobilis.* Sir John Walrond writes of one of his trees that "for several years the lower branches feathered to the ground and grew in regular formal whorls, so that the tree was perfect and symmetrical throughout. For some years, however, the lower branches have died off, now leaving one third of the trunk bare, although there is no want of healthy vigour above. These trees have never shown signs of coning, though all those of *A. nobilis* have done so freely." *A. magnifica* starts into growth in this country much later than *A. nobilis*, and is therefore less liable to injury from frost. If what is above said be correct, it would seem that both forms extend northwards into Oregon, but that the typical *nobilis* is replaced in the south by the *magnifica* form. Assuredly the character of the four-sided and ungrooved, as contrasted with the flat and grooved leaves (Pl. IV., top fig.), cannot be entirely depended on any more than the size, proportion, and form of the scales and bracts. The habit in gardens is certainly different. Intermediate forms, however, occur, one of the most remarkable of which is that figured in Pl. V., and received from Mr. Heale, the obliging manager of the Cranston Nursery Company. In this specimen the habit and the foliage are, for the most part, those of *magnifica*, but the leaves on the sterile branches are slightly grooved as in the true *nobilis*,

while those on the cone-bearing branches are four-sided, 1¼ inch long, upturned, and with the midrib prominent on both surfaces. The olive-brown cones are in form more nearly like those of *magnifica*, as also are the scales, but the long golden-brown bracts are more like those of *A. nobilis*. Instead of being deflexed, however, they project at right angles as shown in the illustration (Pl. V.). In one of the cones the bracts, as they dried, became partially bent downward, but this was not the case with the other two cones. Little stress, however, can be placed on the direction of the bracts, nor even on their relative length. Alexander Braun (Sitz. Bot. Vereins Brandenburg, June 26, 1874, describes a cone of another species wherein the bracts and scales of the upper half of the cone were reflexed, while those in the lower part were in their usual position. Professor Sargent writing in the Gard. Chron., January 2, 1886, of the illustration above referred to (Pl. V.), considers it to represent probably a form of *magnifica* with exserted bracts, and Mr. Syme also, in litt. (Feb. 1886), considers the foliage to be more decidedly like that of *A. magnifica* than that of *A. nobilis*. The cone, too, is more like that of *magnifica* except for the exsert bracts. Sargent also adopts Engelmann's latest views published in Coulter's 'Botanical Gazette,' vii. p. 4, as follows:—"*Abies nobilis* (Douglas), Lindley, is peculiar to the higher mountains of Oregon, and has not yet been found in California, nor, as far as I can see, in Washington Territory. Its greenish leaves crowded on the branchlets, and its large purple cones, with long exsert recurved bracts, well characterize it. The tree on Mount Shasta which has gone by this name (also in the 'Flora of California') is distinguished by its quadrangular leaves keeled on the upper side; its large cones considerably resemble those of *nobilis* and have often, not always, exsert and recurved bracts. It is a form of *A. magnifica*, Murray, the common Red Fir of the Californian Sierras, which has bracts normally enclosed."

Abies religiosa, *Schlect.* (Plate VI.)

Abies religiosa, *Schlectendal in Linnæa*, v. p. 77; *Lindley*; *Spach*; *Carrière*; *Mast. in Gard. Chron.* Jan. 10, 1885, p. 56.

Picea religiosa, *Loudon, Arboretum*, iv. p. 2349; *Gordon*; *Murray in Gard. Chron.* April 29, 1876.

Pinus religiosa, *Humb. Bonpl. et Kunth, Nov. Gen. et Spec.* ii. p. 5; *Parlatore in DC. Prodr.* xvi. ii. p. 420 (1868); *Seemann, Botany of 'Herald.'*

Pinus hirtella, *Humb. Bonpl. et Kunth, l. c.*

Abies hirtella, *Lindley*; *Carrière.*

Picea hirtella, *Loudon.*

In montibus Mexici et Guatemalæ, alt. 4000 ped., *Humboldt, Hartweg* !, *Roezl* !, *Linden* 3 !, *Bourgeau* 1143 !, *Christy* !, *Parry et Palmer* 847 !, *Seemann* !; Guatemala, *Skinner* !

This beautiful Fir varies in the amount of pubescence of the stem, in the colour of the leaves and cones, and also in degree of hardihood.

The leaves start from all sides of the branches, but are so twisted as to form about four rows, one on each side of the branch, from which the leaves come off, at an angle of about 40°, and two others disposed along the centre of the horizontal branches, the individual leaves being given off at an angle of 10°, the lateral leaves thus spreading more or less horizontally away from the branch, the uppermost ones appressed to it, and more or less parallel in direction to it. The largest leaves measure about 1½ inch. In form they are linear, pointed, curved, deeply grooved on the deep green upper surface along the midrib, silvery-grey on the under surface between the prominent midrib and the strongly recurved margins. On a cross section the deep central groove on the upper surface is very conspicuous, as also are the revolute margins. The two resin-canals are close to the epidermis on the lower surface, and the strengthening cells or hypoderm are either continuous, or in other specimens they do not form a continuous layer but are broken up into detached masses. In all the native Mexican specimens examined by me the hypoderm was continuous.

The buds at the end of the lateral shoots are subglobose, covered with whitish or pale violet obtuse scales.

The cones are erect, 5 by 2½ inches, cylindric, oblong, slightly narrowed towards the top, rich dark violet, or in some cases paler, covered with whitish resin, with prominent bracts ending in an acuminate point and markedly reflected. (See Pl. VI.)

My knowledge of the cultivated plant is derived from specimens grown in the garden of the Hon. and Rev. J. T. Boscawen, Lamorran, Cornwall, and of Mr. Smith Barry, Fota Island, Cork. In the latter garden there are two varieties, differing as above

mentioned in colour and in hardihood, which is significant in view of the question as to the specific distinctness or otherwise of *A. hirtella*.

Fig. 22.

Foliage of *Abies Fortunei*.

Abies Fortunei, *A. Murr.*

Abies Fortunei, *A. Murray, Pines and Firs of Japan* (1863), p. 49; *Hance in Journal of Botany*, vol. xx. (1882) p. 32; *Gordon, Pinetum*, ed. 2, p. 27; *Masters in Journ. Linn. Soc.* vol. xviii. p. 522, *et in Gard. Chron.* March 15, 1884 [April 3, 1866], c. ic. xylog. hic repet.

Abies Jezoensis, *Lindl. in Paxton's Flower Garden*, May 1850, *et in Gard. Chron.* 1850, p. 311; *Flore des Serres*, vol. vii. 223, vol. ix. p. 7; *not of Siebold and Zuccarini.*

Picea Fortunei, *Murray, Proc. Hort. Soc.* 1862, p. 421.

Keteleeria Fortunei, *Carrière, Revue Horticole*, 1868, p. 132, c. ic. col.

Pseudotsuga Jezoensis (*nomen tantum*), *Bertrand in Ann. Sc. Nat.* sér. 5, *Bot.* t. xx. p. 87.

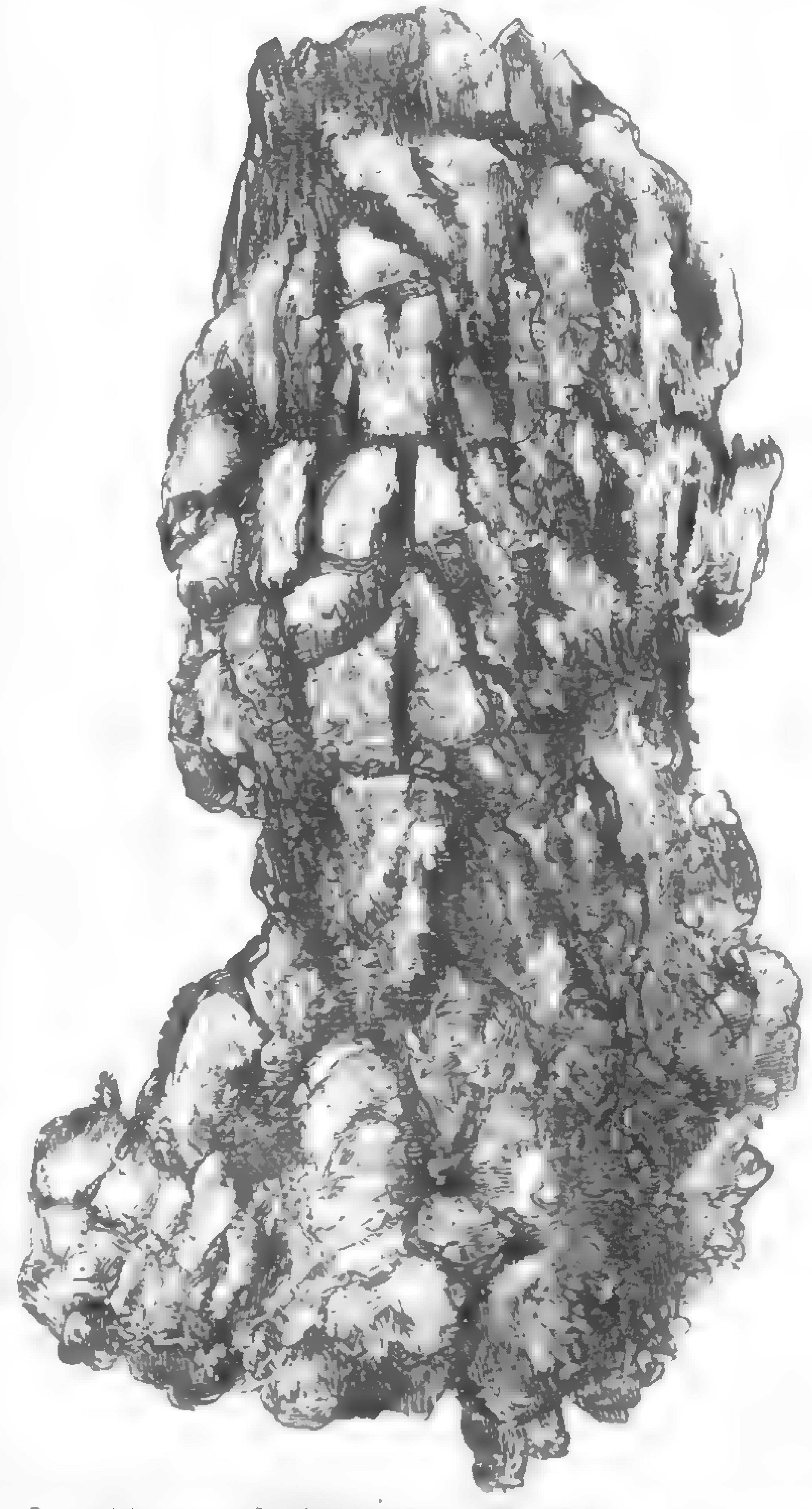
Pinus Fortunei, *Parlatore in DC. Prod.* xvi. ii. p. 430 (1868).

In China austro-orientali ad templum prope Foo Chow Foo, *Fortune*, n. 50!; *Alfred Hance* (1873); *et W. Hancock* (1881), fide Hance supra citat. Frequens in montibus ad septentrionem, Foo Chow, *Maries*!

The history of this tree is now well known, and the confusion with *A. Jezoensis* has been well cleared up by the late Mr. Andrew Murray.

Fortune speaks of it as a magnificent tree with the habit of a Cedar of Lebanon, with beautiful erect purple cones thickly grouped, like rows of soldiers, on the branches. Fortune saw but the one tree in the vicinity of a temple, where it has been seen by other travellers.

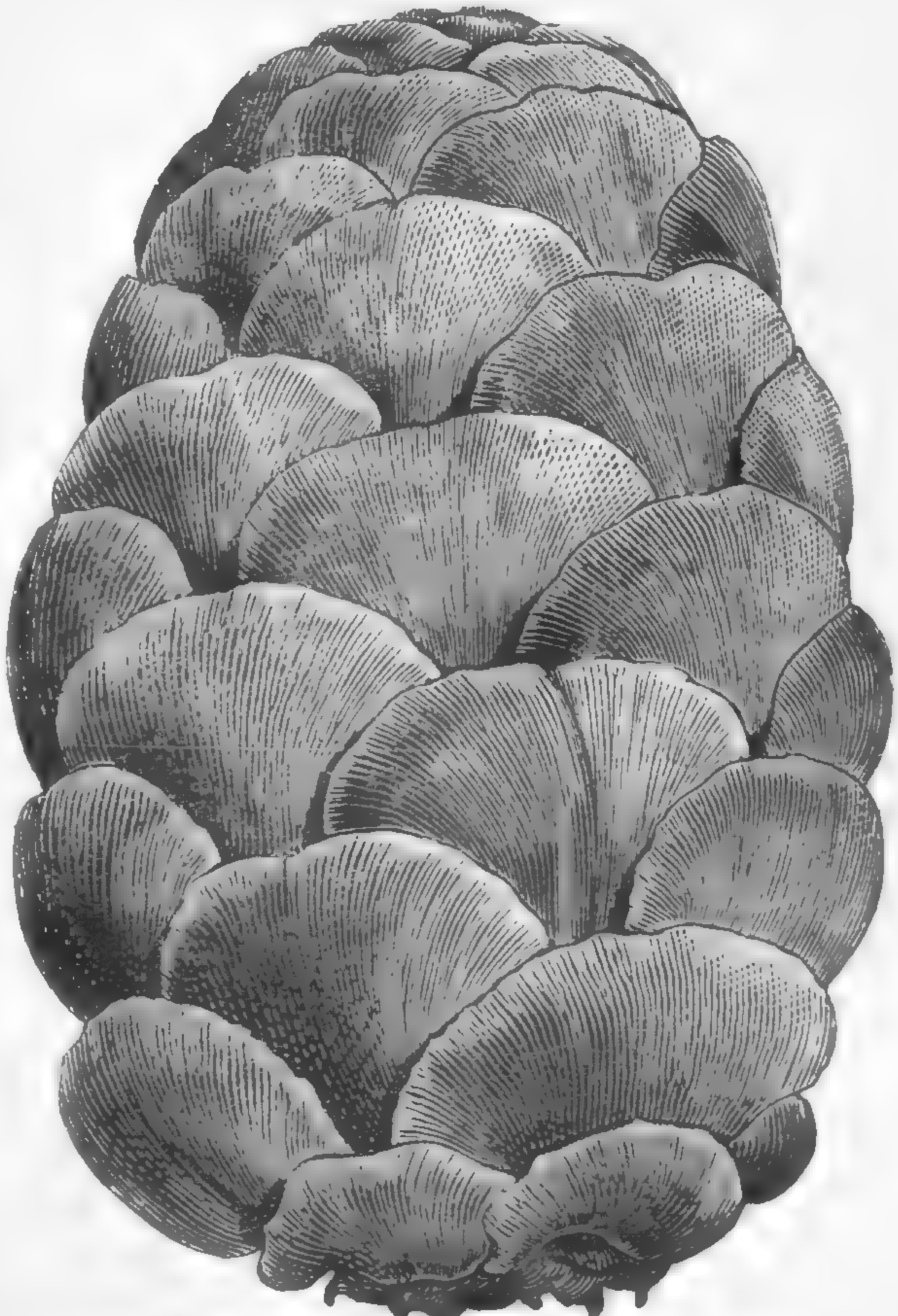
Fig. 23.



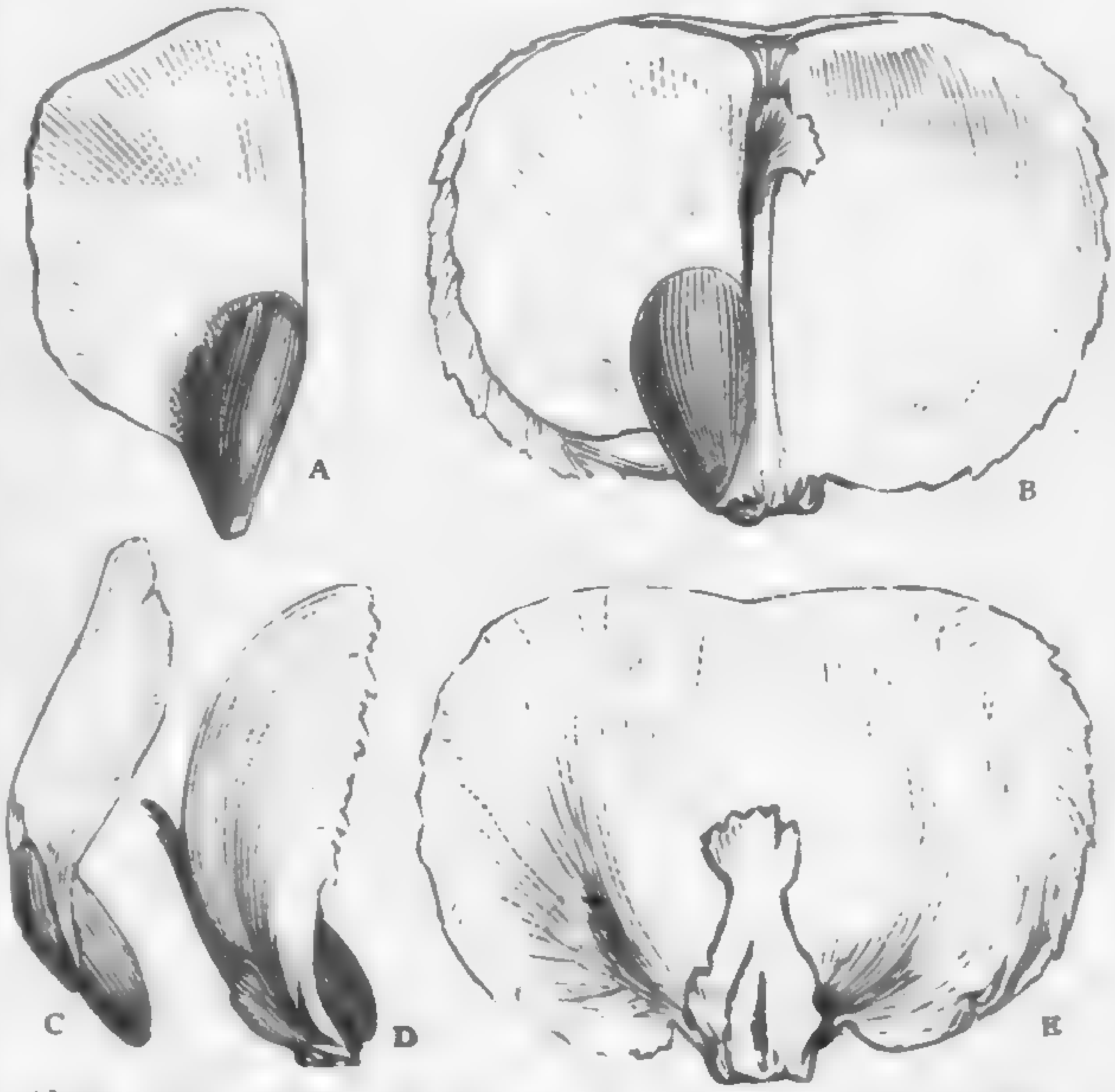
Abies Fortunei.—Portion of the bark to show its cork-like character. Cultivated specimen.

In this country the tree has not thriven; but in the Nursery of Signor Rovelli, at Pallanza, is a magnificent specimen of oblong or pyramidal form, with rather dense verticils of horizontally spreading branches and with thick spongy cracked bark like that of the Cork-Oak (woodcut, fig. 23). The smaller branches are grey, marked with the circular leaf-scars of a Silver Fir. The young shoots are glabrous, orange-red. The buds are ovoid oblong, with oblong, rather acute brownish scales, membranous at the edges. The lowermost scales are acuminate, and transitional in form between the leaves and the bud-scales. The leaves are in many ranks, spreading more or less on all sides. On section, they show a layer of hypoderm beneath the epidermis, palissade cells, transfusion-tissue, and a central fibro-vascular bundle surrounded by a well-marked sheath. The resin-canals are two in number, one on each

Fig. 24.



Abies Fortunei.—Cone erect. Cultivated specimen.



Abies Fortunei.—A, seed; B, seed-scale and seed; C, side of seed; D, side of seed-scale, showing bract; E, bract and seed-scale.

Fig. 25.

Cone-bearing branch of *Abies Fortunei*, reduced one half; cultivated specimen.

side above the lower epidermis and near to the edge of the leaf. The cones (fig. 24), which are stalked, vary considerably in size and less so in form. The bracts in the Italian specimen are shorter than the rounded scales, and usually concealed; but here and there the persistent acuminate tip of the bract belonging to a given scale projects in the interspace between the upper part of the two scales beneath it; and the seeds are provided with a hatchet-shaped wing. Mr. Bentham was quite correct when, in the 'Genera Plantarum,' iii. p. 442, referring to Carrière's genus *Keteleeria*, he said:—"*Keteleeria* .... est verisimiliter Abïetis species, strobili squamis diu persistentibus." Hance (*l. c.*) concurs in this opinion; and as the leaf-insertion is that of the Silver Firs, and the cones erect, not, as once supposed, pendent, there is no ground for including it among the Spruces (*Picea*), still less for considering it the representative of

Fig. 26.—*Athrotaxis laxifolia*, cultivated specimen, with cones.

a distinct genus intermediate between the Spruces and the Silvers.

Athrotaxis laxifolia, *Hook.*

Athrotaxis laxifolia, *Hook. Ic. Pl.* t. 573; *Lond. Journ. Bot.* iv. p. 449; *Fl. Tasman.* p. 354; *Parlatore in DC. Prod.* xvi. pars ii. p. 434; *Masters in Gard. Chron.* Nov. 7, 1885, p. 584.

Of this species, originally described by Sir Joseph, then Dr., Hooker, Parlatore writes, *l. c.*:—"Species in plantis vivis melius illustranda." In truth, the figure heretofore published (destitute of cones) and the descriptions given were not sufficient to enable the botanist to decide whether *A. laxifolia* was entitled to specific rank, or whether it was not better to consider it a mere form of *A. cupressoides*, or perhaps an intermediate between that species and *A. selaginoides.* The evidence now available would rather lead to the notion that although all three may be derivatives from one form, they are now sufficiently differentiated to be kept distinct. *A. laxifolia*, as the name implies, has the leaves not so closely appressed in the other two species, and different also in shape. The cones are subglobose, the scales spirally arranged, each with a long stalk-like portion, dilated above into a thickened club-shaped extremity, from the dorsum of which proceeds an ovate acute, up-turned, originally leafy process. The seeds are roundish, provided with a deep wing on either side.

The specimen figured (woodcut, fig. 26) was obtained from the collection of John Rashleigh, Esq., Menabilly, Cornwall.

The species of *Athrotaxis* may be compared with the figures of *Walchia imbricata*, Schimper* (Permian), and especially with *Echinostrobus Sternbergii* from the lower Cretaceous beds.

Cephalotaxus pedunculata, *Siebold & Zucc.*

Cephalotaxus pedunculata, *Siebold and Zuccarini, Flor. Japon.* ii. t. 133; *Endlicher, Carrière*; *Parlatore in DC. Prod.* xvi. ii. p. 503; *Mast. in Gard. Chron.* Jan. 26, 1884, p. 113.

In Japonia, *Siebold*; China, *Fortune*?

Of this species, only the male plant is described by authors; but if I am correct in my determination, some of the female plants called in gardens *C. Fortunei* really belong here. Seeds

* Renault, 'Cours de Botanique Fossile,' 1885, tab. 8, *Walchia*; tab. 12. f. 14, *Echinostrobus.*

have been produced on some of these plants, and which are placed on deflexed stalks about half an inch long, rather shorter than the ovoid fawn-coloured fleshy seeds. Fortune, on his second visit to China, ascertained that this plant was quite distinct from *C. Fortunei*; and, on his authority, *C. pedunculata* is cited as a Chinese plant, though there are no specimens from that country

Fig. 27.

Seed-bearing shoot of *Cephalotaxus pedunculata*. Drupe-like seeds, olive-coloured. Cultivated.

in the herbarium (see Fortune in Gard. Chron. Nov. 28, 1863, p. 1134). It is supposed that the flowers of a female plant of this species which bore seed in Messrs. Paul's Nursery at Cheshunt might have been fertilized by the pollen of the Yew; but there is unfortunately no record of the seeds having been sown.

In the garden of the Rev. J. Goring, of Steyning, Sussex, is a

bush which seems to differ from *C. pedunculata* principally in the globular berry-like seeds, unlike anything yet described in the genus. The shoots, moreover, have a brownish chestnut colour. As the foliage is so like that of *C. pedunculata*, I have preferred to consider it as a variety of that species. It is very probable that this is the female plant above referred to which Fortune met with on his second journey (Gard. Chron. 1863, p. 1134), and which appeared to him to be "new to science." Be this as it may, Mr. Goring obtained both trees—*pedunculata* true, and the present one (*pedunculata*, var. *sphæralis*)—from a nursery at Bagshot in 1865 or 1866, under the name of *C. Fortunei*; but certainly neither of them seems entitled to that appellation. It should be stated that the globular form is much less apparent in the dried specimens.

The new variety, of which an illustration is appended, may be thus characterized:—

Var. SPHÆRALIS, nov. var. ramis pallide castaneis; novellis viridibus glabris; foliis 1½–2 pollic. lineari-falcatis sensim acuminatis, planis vel leviter arcuatis; gemmarum terminalium squamis oblongis acutis, haud acuminatis, amentis masculis . . . . pedunculis seminiferis versus basin ramulorum aggregatis ½ poll. long. seminibus drupaceis sphæricis parum brevioribus. Ex hort. Goring. (Plate VII.)

Picea Omorika, *Pan˘ic.* (Plate VIII.)

Picea Omorika, *Pančic, C. Bolle, Monatsb. des Vereines zur Beförderung des Gartenbaues*, 1877; *Reichenbach in Botanische Zeitung*, 1877; *Gard. Chron.* April 14, 1877, p. 470, et May 19, 1877, p. 620, March 8, 1884, p. 308; *Ascherson, Sitzb. der Gesells. Naturfreunde zu Berlin*, 1881; *Boissier, Flora Orientalis*, v. p. 701, sub *P. orientali* obiter.

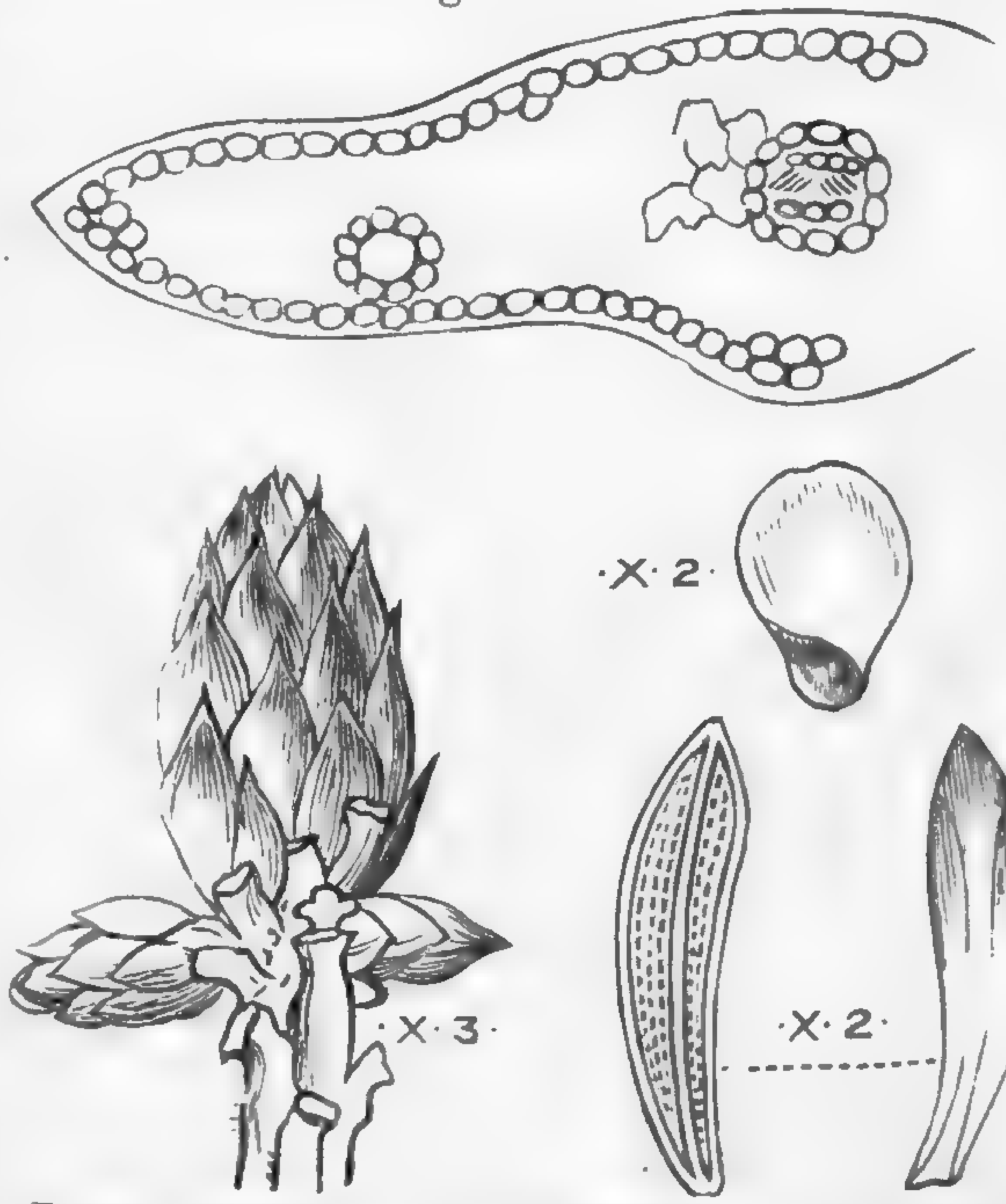
"Arbor excelsa, coma anguste pyramidali; ramis brevibus subverticillatis, superioribus erectis, mediis horizontaliter patentibus ac inferioribus pendulis cum apicibus arcuatim adscendentibus; ramulis hirsutis; foliis solitariis, rectis aut incurvis planiusculis, nervo utrinque prominulo, obsolete tetragonis apice acuminatis acutis aut obtusis cum apiculo cartilagineo, superiore pagina eximie glaucis; strobilis sat parvis oblongis in ramis variæ longitudinis erectis, horizontaliter patentibus aut pendulis; squamis a basi cuneata subrotundis, dorso sub apice striatis margine eroso-denticulatis; bracteis obovato-cuneatis apice denticulatis, sua squama multo brevioribus; nuculis parvis obovatis ala obovata-

cuneata subobliqua margine subintegra triplo brevioribus."—*J. Pančic.*

This tree is still so little known that it may be convenient to repeat Dr. Panˇic's diagnosis, and lay before the reader an illustration from a specimen collected by Dr. Pančic in the mountains of Servia (Plate VIII.). It also occurs in Bosnia and Montenegro. For the opportunity of doing this and of examining the specimen, I am indebted to Messrs. Froebel of Zurich and to Mr. George Nicholson.

The shoots have the "pegged" character common to the Spruces, due to the projections at the base of the leaves, and are moreover covered with short stiff hair. The buds (woodcut, fig. 28) are ovoid conic, dull brown in colour, and invested by ovate-lanceolate scales. The leaves are flattish, straight or laterally curved, between half and three quarters of an inch in length, linear, oblong obtuse, convex, and shining green on the dorsal surface, slightly flattened near the point; the ventral surface is marked by a prominent midrib, on either side of which are lines of stomata. There is no indication of any twisting of the leaf; hence the stomata are really on the upper surface of the blades, as in some Junipers and other plants. A transverse section, when examined under the microscope, shows a layer of hypoderm-cells beneath the epidermis, and investing the ground tissue of the leaf, which consists of spheroidal cells with undulating boundary-walls and with a very slight tendency to form palissade-cells on the lower side, that furthest removed from the stomata. Close beneath the hypoderm on the lower surface are two resin-canals, one on each side midway between the centre and the margins; each is surrounded by strengthening-cells.

Fig. 28.

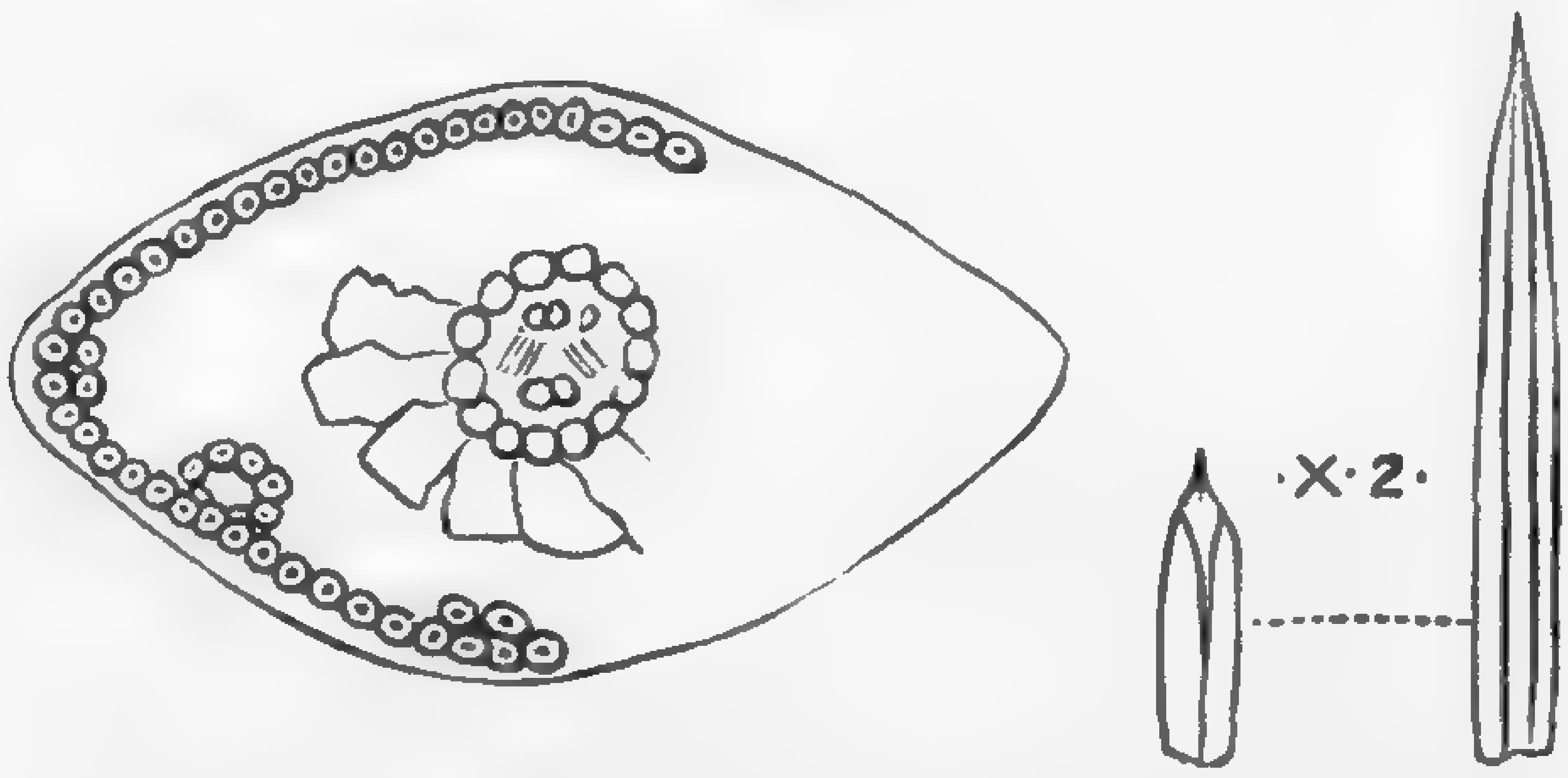


Picea Omorika.—Plan of section of leaf, much magnified: bud ×3; seed ×2; leaves, front and back, ×2.

The central bundle of fibro-vascular tissue is surrounded by a well-marked bundle-sheath, and has the xylem above and the phloem beneath in the usual manner.

Picea orientalis, which has been compared with it, has shorter leaves, more acutely pointed and more four-sided in section. The cells also which surround the central bundle-sheath are in *P. orientalis* of an oblong form, and radiate from the central bundle on all sides. Their walls are undulated. Hence, then, the superficial appearance, no less than the internal structure of the leaves, is quite distinct in the two species; a comparative examination of which, therefore, confirms Dr. Pančic's view, that he had to do with a previously undescribed species, and not with a form of *P. orientalis*. Moreover, the cones of *P. orientalis* are longer and the scales broader than in *P. Omorika*.

Fig. 29.



Picea orientalis.—Leaves and plan of leaf-section.

Pinus Peuke, *Griseb.*

Pinus Peuke, *Grisebach, Spicil. Flor. Rumel.* ii. p. 239; *Christ, Europ. Abiet.* p. 9; *Endlicher, Conif. Synops.* p. 144; *J. D. Hooker in Journ. Linn. Soc.* 1865, p. 146, *et in Gard. Chron.* Feb. 24, 1883, p. 244; *Boissier, Flora Orientalis*, vol. v. (1884) p. 698; *Engelmann in Trans. Acad. St. Louis*, iv. 1880, p. 170, *Revision*, p. 18.

Pinus excelsa, *Parlatore in DC. Prod.* xvi. ii. p. 405, *ex parte, haud Wallich.*

P. Cembra, var. fruticosa, *Grisebach, Reise in Rumelien*, p. 189, *teste Parlatore, l. c.*

"In [Macedonia] Scardo australi in monte Peristeri prope Bitoliam, alt. 2400–5000 ped.," *Grisebach, Heldreich (ex Parlatore).* In monte Perimdagh supra Nevrekop Janka, in monte Rilo Thraciæ, *Pančicii, teste Boissier, l. c.*

For my knowledge of this Pine I am entirely indebted to Sir

Fig. 30.

Pinus Peuke; cultivated.

Joseph Hooker; and I can add but little to what he has published on the subject; but as the tree is still comparatively little known, it may be well to repeat the illustration already published in the 'Gardeners' Chronicle,' and add a few details taken from the cultivated tree.

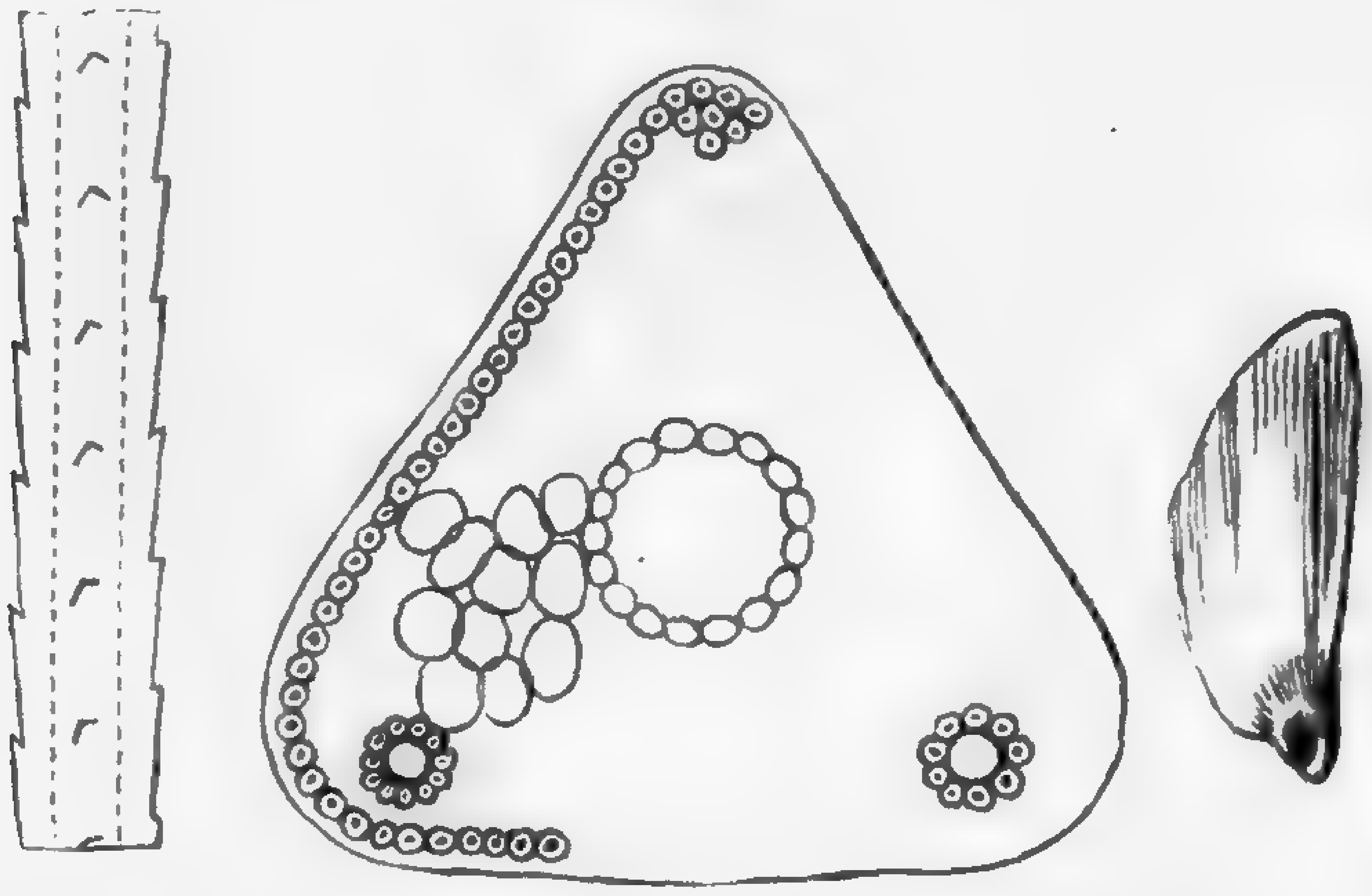
The chief interest attaching to the tree lies in its close resemblance to the Himalayan *Pinus excelsa,* a resemblance so close that at first it was considered merely as a geographical variety of that species. On further acquaintance, however, the differences between the two trees become more obvious; and, although the resemblances are sufficiently great to justify the hypothesis that the two may have had a common origin, the divergences warrant the keeping of the two forms distinct for practical purposes.

Boissier thus sums up the differences:—"Affinis *P. excelsæ* a qua tamen differt foliis brevioribus in ramulo toto persistentibus (nec prope apicem ramulorum confertis); strobilis multo brevius pedunculatis abbreviatis 3–4½ pollices nec 6–7 pollices, longis; squamis superne sulcatis; seminis ala longiore."

The trees at Kew, from which the illustration was taken, were derived from seed collected in Grisebach's original locality by Professor Orphanides, and sown at Kew in 1864.

The bark of the trunk is smooth smoky brown, that of the branches olive-coloured. The herbaceous shoots are glaucous green, destitute of leaves near the base. The buds, like those of *P. excelsa,* are elongate-ovoid, conic, covered by numerous lanceolate acuminate brown scales somewhat reflexed at the tips. The leaves are similar to those of *P. excelsa,* but shorter. Their

Fig. 31.



Pinus Peuke.—Portion of leaf, magnified. Plan of leaf-section, magnified. Imperfect seed, real size. Cultivated specimen.

anatomical conformation is essentially the same (woodcut, fig. 31). There is a layer of hypoderm beneath the epidermis, which encircles the homogeneous parenchyma of the leaf. The bundle-sheath is well marked. The resin-canals are placed one on each side at the dorsal side of the leaf near the epidermis, and surrounded by strengthening-cells. Engelmann attributes peripheral ducts to this species; but I find them just within the epidermis. The historian of the genus *Pinus* also says there is little hypoderm, and none round the ducts. It is possible that there may be some variation in these particulars, or Engelmann may not really have examined the true *P. Peuke*. That there is some confusion is shown by the fact that in his tabular statement he includes *Peuke* among species with few strengthening-cells and none round the ducts; while in the more detailed notes he mentions the hypoderm as forming a continuous layer. The male catkins are in clusters of a yellow colour, each oblong-obtuse (anther-crest roundish, pale violet). The stalk of the cone and the cone itself, as shown in the illustration (fig. 30, p. 206), are much shorter than in *P. excelsa.*

Endlicher, after alluding to other points of distinction from *P. excelsa*, goes on to describe the venation of the wing of the seed as parallel, while in *P. excelsa* it is "tortuose venoso-reticulata."

Pseudolarix Kæmpferi, *Gordon*. (Plates IX. & X.)

Pseudolarix Kæmpferi, *Gordon, Pinetum*, p. 292, 1858; *Henk. et Hochst.*; *Carrière.*

Larix conifera, *Kæmpfer, ex Parlatore.*

Abies Kæmpferi, *Lindley in Penny Cyclopædia*, p. 34, *et in Gard. Chron.* 1854, p. 255, f. 455; *A. Murray, Pines and Firs of Japan,* 1863, p. 100, c. ic. xylog.

Larix Kæmpferi, *Carrière in Flore des Serres*, xi. p. 97.

Pinus Kæmpferi, *Lambert, Pinus*, ed. 3, p. vii, *ex Parlatore in DC. Prod.* xvi. ii. p. 413 (1868).

In montibus Chinæ orientali-borealis provinciæ Che Kiang ad 3000 ped. circ. elev. *Fortune*!

The so-called Golden Larch was in the first instance botanically described by Lindley in the 'Gardeners' Chronicle,' 1854, pp. 255 and 455, with a figure of cone (woodcut, fig. 32), under the name of *Abies Kæmpferi*, under the impression that it was one of the plants mentioned by Kæmpfer in Japan. This, how-

ever, appears to be a mistake. The tree is not Japanese so far as known, but is a native of the central, northern, and eastern provinces of China. It was introduced to this country by Fortune, who called it a Larch (*Larix*), although the scales of the cone, instead of being persistent, "are so deciduous, that it is scarcely possible to hold them together."

Fig. 32.

Cone of *Pseudolarix Kæmpferi*, real size. Native.

Fortune could not assent to its being called an *Abies* unless Cedars and Larches are also referred to the same genus. "It is," he says, "apparently a plant exactly intermediate between the Cedar and the Larch; it has deciduous cone-scales, like the Cedar, and deciduous leaves like the Larch, and a habit somewhat of the one and somewhat of the other" ('Gardeners' Chronicle,' 1855, p. 643). Gordon, recognizing its distinctness from *Abies*, Cedar, or Larch, called it in his 'Pinetum' *Pseudolarix Kæmpferi*, thus putting it into a new genus, to which objection was raised at the time on the score that the proposed name was an "ill phrase—a vile phrase"!

A. Murray preferred to keep to Lindley's nomenclature, and

was of opinion that it was nearer to the Silver Firs than to the Larches. Carrière called it *Larix Kæmpferi*. Lambert and Parlatore grouped it under *Pinus*.

It is not necessary to cite other authors, who have only copied what their predecessors have said; but it may be stated that Mr. Bentham, in the 'Genera Plantarum,' ii. p. 442 (1880), after pointing out its peculiarities, concluded that the tree must either be affiliated to the Cedars or considered as a distinct genus; the male flowers, however, were unknown to him.

This deficiency I have the satisfaction, thanks to the courtesy of Signor Rovelli, of removing. One of the most remarkable trees in the nursery of Signor Rovelli, at Pallanza, Italy, is a tree of this species, which in 1884 put forth male catkins. These male catkins settle the point. It is clearly not a *Pinus* (except in the very widest and practically most inconvenient sense). It is not an *Abies* (Silver Fir), nor a *Picea* (Spruce), nor a Cedar, nor a Larch; but is the representative, as Gordon said, of a distinct genus. In spite of "his ill-phrase," we consider ourselves, therefore, bound to adopt his designation. The male catkins are different from those of any Conifer known to us. To some extent they remind us of those of the Ginkgo, which are stalked, grow in tufts in the same manner, but which are mixed with the leaves. It is needless to say there is little or no other resemblance to the Ginkgo. The catkins resemble those of *Cunninghamia sinensis*; but are pendulous, not erect, and are arranged in umbels at the apex of short spurs invested by brown membranous scales (Plate X.). Each catkin is stalked, the stalk being recurved, so that the catkin itself is pendulous, oblong, about three quarters of an inch long, apple-green in colour. The lower anthers are subglobose, almost sessile, the upper ones are prolonged into a long appendage, sometimes lanceolate, sometimes, as shown in the drawing, 3-lobed at the apex. The pollen-grains, drawn by Mr. W. G. Smith, have each two bladders, as in the Pines &c.

The tassel-like catkins, not fully developed in our specimen, must clearly be very ornamental, and are quite different from the solitary sessile catkin of the Larch. The adult foliage and cones from Signor Rovelli's plant are shown on Plate IX.

Fortune first met with it as a dwarfed pot-plant, telling us that when at a height of some 18 inches the Chinese contrive to make it assume the guise of an aged Cedar of Lebanon. Ultimately

he found the tree growing in the vicinity of a Buddhist monastery near Chekiang. The trunk of one specimen had a girth of 5 feet and a height of 120 or 130 feet. At Quanting, 20 miles away from the first locality, Fortune came upon a sloping hill "covered with the beautiful object of our search." The trees he notes all appeared to have been planted. "One tree in particular seemed the Queen of the Forest, the trunk measuring 8 feet in circumference and 130 feet in height, with the lower branches nearly touching the ground." The circumstance that the trees appear to have been planted is of importance with reference to the origin of the tree. Two explanations have been offered of the fact that curious trees, such, for instance, as the *Abies Fortunei*, are found in the vicinity of temples and monasteries in Japan, China, Sikkim, Tibet, and other Buddhist countries. One explanation is that the trees have been brought from elsewhere by the Buddhists—but if so, whence? The other is the view taken by Dr. Hance (whose authority on such a point is very great), that the trees form the remnants of the indigenous forest preserved around the temples, from feelings of veneration, but destroyed for timber or by fire in other parts of the country.

In the 'Journal of Botany,' 1875, p. 138, as has been kindly pointed out to me by Mr. F. B. Forbes, Dr. Hance alludes to the "Gold Pine" (*King-sung* or King-ts-ien-sung), found by the Rev. G. E. Moule in the hills west of Ningpo. This Dr. Hance refers to *Larix davurica*, but, as Mr. Forbes suggests, it is probable that *Pseudolarix Kæmpferi* is really the tree intended. Mr. Moule says that the tree is not so spiral in figure as the European Larch, but more like a Cedar, except that the branches do not stratify.

Bertrand (Ann. Sc. Nat. t. xx. 5 sér. p. 90) includes this plant under *Larix*, of whose leaf-structure he gives a figure and description. He distinguishes it from the other species of *Larix* (except *L. europæa*) by the absence of stomata on the upper surface, while, according to him, there is hypoderm and four rows of stomata on either side of the midrib in the European species, as contrasted with the absence of hypoderm and the presence of nine rows of stomata in the Chinese species. The only leaf I have yet examined of this species presented a different structure from that indicated by Bertrand, one in many points unlike that of the Larch. The leaf-section is transversely

oblong, the midrib prominent on both surfaces, especially below; the epidermal cells are papilliform, and project like those of the petals of a flower. There is no hypoderm; but beneath the upper epidermis are two rows of cuboidal cells, or imperfect palissade-cells full of chlorophyll. The centre of the leaf is occupied by transfusion-tissue, and the single central fibro-vascular bundle is surrounded by a ring of very large colourless cells constituting the bundle-sheath. The resin-canals are three in number—one on the upper surface under the projecting midrib, a most unusual position, and two others on the under surface of the leaf, one on each side above the epidermis, and near to the edge. All three are surrounded by strengthening-cells.

DESCRIPTION OF THE PLATES.

Plate II.

Abies amabilis, Forbes. Sterile branch, nat. size.

Plate III.

Abies grandis, Lindl. British-grown cones, nat. size.

Plate IV.

Abies nobilis, Lindl. British-grown cone, nat. size, kindly lent by Messrs. Veitch. A. Plan of section of leaf, showing grooved upper surface; A A. Resin-canals. B. Seeds, scales, and bracts of cultivated specimen.

Plate V.

Abies nobilis, var. *magnifica*, hort. Cones of home-grown specimen.

Plate VI.

Abies religiosa, Schlecht. Cone and foliage. A. Bract, two views. B. Scale. C. Leaf and cross section.

Plate VII.

Cephalotaxus pedunculata, var. *sphæralis.* Fruit and foliage. A. Longitudina section of fruit.

Plate VIII.

Picea Omorika, Pančic. Cones and foliage.

Plate IX.

Pseudolarix Kæmpferi, Gord. Cones and foliage, nat. size. A. Leaf and cross section. B. Scale and bract.

Plate X.

Pseudolarix Kæmpferi, Gord. Branch with fruit. A. Male catkins. B, C, D, E. Sectional outline of stamens. F & G. Pollen.

On the probable Wild Source of the whole Group of Cultivated True Limes (*Citrus acida*, Roxb., *C. medica*, var. *acida* of Brandis, Hooker, and Alph. de Candolle). By E. Bonavia, M.D., Brigade-Surgeon, Indian Med. Department. (Communicated by W. T. Thiselton Dyer, F.R.S., C.M.G.)

[Read 4th February, 1886.]

Dr. Brandis, in his 'Indian Forest Flora,' considers the small sour Lime as a variety directly descended from the Citron, *Citrus medica*, Linn. Sir J. D. Hooker, in his 'Flora of British India,' follows Dr. Brandis; and Alph. de Candolle, in his 'Origin of Cultivated Plants,' follows them both.

It always struck me that the characters of the Lime-tree were very different from those of the Lemon and Citron trees; and I could not therefore persuade myself to accept the relationship given by Dr. Brandis as a finally settled point.

Some time ago I took up the study of the cultivated forms of *Citrus* of India with a commercial object, that is, with the view of ascertaining how this useful genus might be turned to some better account in India and Ceylon than it has hitherto been. I collected specimens from all parts, and observed leaves and fruit; and in lately travelling from the North-West Provinces of India to Ceylon by the Western coast, I had opportunities of seeing Limes and their leaves. I have always been struck with the persistence of the winged petiole in the Lime (*C. acida*, Roxb.), while the Lemon and Citron rarely had it. One cannot help being struck also by the aspect of the Lime-tree, so different from the Lemon and Citron trees.

In Ceylon, one day, I asked Dr. Trimen to show me what he had in the way of *Citrus*-trees in the Royal Botanical Garden of Peradeniya. While going over the ground, his foreman placed in my hands a *Citrus*-fruit, which I had never seen before, and which he said he had obtained from an adjoining Cocoa estate. This *Citrus* in Ceylon is called *Lima*, or *Kùdalu dèhi* (Leech Lime). It flashed across my mind that I held in my hand the wild form of the ancestor of all the cultivated true Limes. Dr. Trimen and myself then visited the tree. The immense winged petiole of the "*Lima*" leaf rather staggered me. The large and small spines and the blade of the leaf were like

those of the cultivated form of Lime. I collected some small leaves of this interesting plant and compared them with the well-developed leaves of an adjoining cultivated Lime-tree, and found that the undeveloped petiole of the "*Lima*" corresponded to the fully-developed petiole of the Lime. The lime-leaves are thinner, and so is the lime-skin. Thin leaf and thin skin often go together. The blossoms of this *Lima* were small, like those of the Lime, with either four or five petals, tinged purple (at the Hakgala Gardens, Newera Eliya, I gathered off a Lime-tree blossoms also tinged purple); some of the *Lima* flowers were male, others hermaphrodite. I afterwards learnt that this *Lima* is never eaten; that its fruit is used boiled, as an insecticide, for washing the head; that it is used by estate coolies, and natives, smeared over their feet, as an antidote against land leeches; that it is often cultivated near villages for these purposes, and is also sometimes found in jungles. This *Lima* appeared to me to have the characters of a wild species; its fruit is warty, thick-skinned, and the rind has an aromatic, resinous scent, and a bitter acrid flavour; the pulp is sour, and of an unpleasant flavour. A riper specimen had an aroma *sui generis* in its greenish pulp, not unlike that of the Indian Lime. The subjoined woodcuts give outline drawings of this *Lima* and its leaves.

Drawings accompanying the MS. give an idea of its warty exterior, one figure distinctly showing a mamilla. The girth of the two specimens is given. All the drawings are natural size *. The section is of A, and shows the thickness of the skin, and the numerous seeds. The woodcuts here given, figs. 1–3, show the leaves of this *Lima* of Ceylon. They are dark green, thick and leathery, with their edges slightly turned backwards. Fig. 1 is

* The illustrations referred to were:—*Lima* of Ceylon, or Kùdalu-Dèhi (Leech Lime); *Limo tuberosus martinicus*, Rumph. Flor. Amboy. vol. ii. tab. 26. fig. 1, or *Citrus Hystrix*, DC., Kurz. Flor. Br. Burma.

Fig. A. Exterior very warty; the warts being studded with pinholes or openings of the oil-cells. Pale yellow when ripe. The rind has an aromatic resinous scent, and a bitter acrid flavour. Essential oil of a gamboge-yellow, and stains paper permanently yellow.

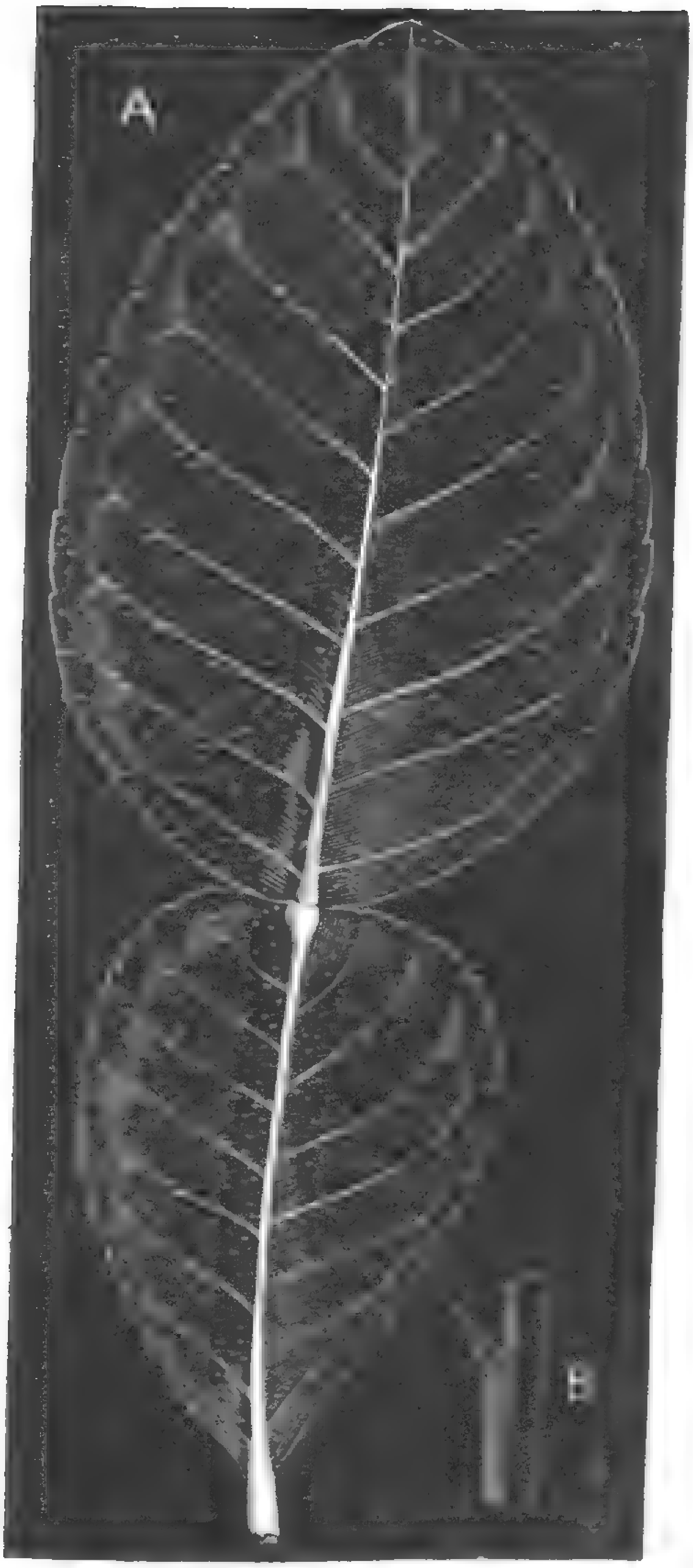
Fig. B. Trans. sect. of A. Thick-skinned; oil-cells numerous, and crowded together; pulp greenish; and juice-vesicles very small. The pulp is sour, and of a very unpleasant flavour. Seeds greenish when cut. Many-seeded.

Fig. C. A third, riper specimen of this *Lima* had greenish pulp and very sour, with a peculiar aroma, not unlike that of the cultivated Lime. The rind had a very unpleasant acrid taste and resinous scent.

Fig. 2.

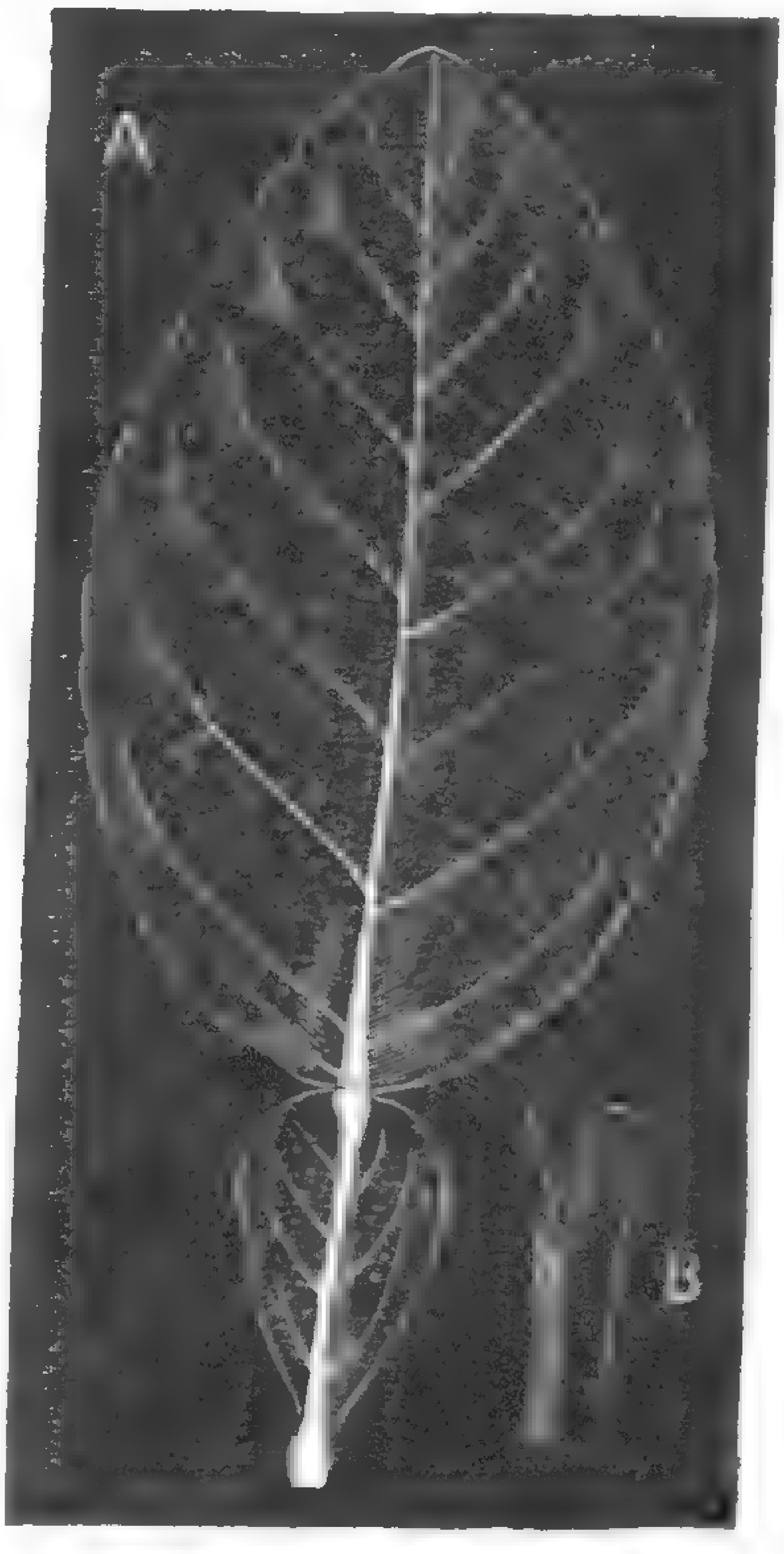
Occasional form of Lima-leaf.

Fig. 1.



A. Well-developed typical form of Lima-leaf of Ceylon; thick, leathery, dark-green edges, slightly turned backwards. B. Spine.

Fig. 3.



A common form of the Indian cultivated Lime.

of a fully developed leaf, probably after the rains; fig. 2, a small and differently shaped, probably a spring leaf. I have shown these, in order to compare their petioles with that of a fully-

developed cultivated Lime-leaf, fig. 3. The petioles are then identical in form. The spines of this wild form and the adjoining cultivated form are identical. The form of the blade of leaf 1 corresponds to that of fig. 3; a very common form in all the cultivated Limes I have seen is rather rounded and broad in proportion to its length. In other respects this *Lima* has all the characters of a *Citrus*.

By the courtesy of Dr. Trimen, I had the opportunity of looking over Rumphius's 'Herbarium Amboinense.' I found that this Ceylon *Lima* had all the characters of his '*Limo tuberosus martinicus*,' vol. ii. tab. 26. fig. 1. Making allowances for Rumphius's artist's inaccuracies, I consider these two identical. The flowers are pictured with 4 petals, and he says "it is used for washing the head."

Vol. ii. tab. 27 of Rumphius gives *Limo agrestis* (in Dutch, Wilde Pap-Lemoen). This is evidently a near relative to *Limo tuberosus*, Mart. It has retained the broad winged petiole, and has lost some of its warts. It is pictured with 4 petals; is of a yellow colour, and its pulp sour and acrid.

Another variety closely connected with *Limo tuberosus* is that shown in Rumphius, vol. ii. tab. 28. It is also pictured with 4 petals and has broad winged petioles. I do not know the name given to this by Rumphius, as the copy of the Peradeniya Library has pp. 105 and 106 missing. [*Limo Ferus*, *Lemon Swangi*, *Wilde Lemoen-Boom*, Latine *Limo Ferus*; juxta Malaicense *Limoen Swangi*, ob irregularem et deformem ejus figuram.—Rumph. Herb. Amb. ii. 106.]

In Rumphius, vol. ii. tab. 26. fig. 3, is given a smooth form of his *Limo tuberosus*, with its identical leaf and 4-petalled flowers. Why Rumphius calls it "ramum *Limonis feri*" I do not know. Of this ovoid smooth form there are many cultivated Limes in India. Some trees produce nothing but this ovoid smooth form.

Rumphius's *Limonellus aurarius*, vol. ii. tab. 30, pictured with 4, and also 5 petals, is, he says, the smallest of all Limes, not used for food, but by goldsmiths for cleaning gold. Observe the large winged petiole he gives to this small form. In India there is a small smooth form, with the smaller petiole of the Indian varieties, which is also used by goldsmiths for a similar purpose. The leaves of this *Limonellus aurarius* are pictured entire. Probably this is an oversight; I never saw a *Citrus*-leaf

of any sort entire, as a typical leaf. Sometimes the small spring leaves appear entire on a superficial inspection.

In Rumphius, vol. ii. tab. 29. fig. B, we have for the first time the Lime, pictured with 4 petals and a small winged petiole, like all the varieties we have in India, like the cultivated Limes of Ceylon, and the Lime of Montserrat, shown in tab. 6745 of the 'Botanical Magazine.'

Nota bene.—Loureiro gives *Citrus limonum*, 'Flor. Cochin Chin.,' as a variety of *Citrus medica*, and refers the reader to Rumph. Flor. Amboyn. vol. ii. tab. 29. Unfortunately this plate gives two different things—Fig. A, which is a *Lemon*, with unwinged petiole, and probably a descendant of *C. medica*; and Fig. B, a true Lime, like the Indian cultivated varieties, and pictured with 4 petals, and which is probably a descendant of *Limo tuberosus* of Rumphius. (Can this plate have given rise to the notion that *C. acida* of Roxb., the *Lime*, is closely connected with *C. medica*, the *Lemon*? Rumphius says that on rare occasions this form is produced (*op. cit.* ii. tab. 29. fig. A) (though probably not on the same tree). Its spines and leaves are those of *C. medica*, Rumph., vol. ii. tab. 25, and, curiously enough, he also gives a smooth form in this latter plate.)

After examining Rumphius's plates and descriptions, I turned to Kurz's 'Flora of Br. Burma,' and under *Citrus Hystrix*, DC. (Shouk-pote), I found the same *Limo tuberosus* of Rumph. and *Lima* of Ceylon in a wild state. If I were writing a description of the *Lima* of Ceylon I would copy Kurz's of *C. Hystrix*—It is "armed with longer or shorter straight axillary spines, all parts glabrous; leaves oval or ovate, $1\frac{1}{2}$–2, rarely 3 in. long, petiole 1–$1\frac{1}{2}$, often 2–3 in. long, leaf-like, expanded, and often larger than the blade itself, obversely cordate or obovate-oblong; at base contracted in a simple petiole; flowers 4 or 5-merous, small, white [in the Ceylon *Lima* I found them tinged purple—E. B.], on very short glabrous pedicels....; ovary obovate, terminated by a very short thick style; berries obovate, or irregularly globose, the size of a citroon or larger [a vague size; I have seen Citrons from 3 to 10 inches long, E. B.], very uneven and warty, almost juiceless, with a thick yellow skin. Not unfrequent in tropical forests of the Martaban hills....; also in Upper Tenasserim. Often cultivated in native gardens."—Kurz, Flor. Brit. Burma, 196–7.

Dr. Trimen also thinks that the *Lima* of Ceylon and the *C. Hystrix* of Kurz are the same thing.

I have not had an opportunity of seeing a larger and riper specimen; but in my mind I have little doubt that the *Lima* of Ceylon and Rumphius's *Limo tuberosus* are direct descendants of Kurz's wild *Citrus Hystrix*, and that from these semi-cultivated descendants all our varieties of Limes have come. It is not improbable that with the Dutch and their Malay servants came to Ceylon the *Lima* as a hair-wash as well as the smooth Lime. Afterwards, the Cinghalese, finding the *Lima* a good antidote against land leeches, gave it the additional name of *Kùdalu dèhi* (*dèhi* is the name of their cultivated edible Lime, and *Kùdalu* means leech).

This semi-wild *Lima* I have never seen or heard of in India, but I think its derivatives are the cultivated forms of Lime, such as the small goldsmiths' Lime, *Limonellus aurarius* and *Limo Ferus* of Rumphius, and other similar common forms of Lime. In any place in India, if you find no other *Citrus*, you are sure to find the small thin-skinned Lime, the *Kaghzi nimboo* (*Kaghzi* means "of paper thickness" with reference to the skin), and it is always raised from seed.

It is not unlikely that the true Limes of India were also introduced by the Dutch. The "*Jambiri*" of India, which is a Sanskrit name, is I think a totally different thing, and owes its origin to another source, although now the two names "*Jambiri*" and "*Kaghzi nimboo*" are often mixed up.

Conclusion.—In my opinion the wild *Citrus Hystrix*, DC., is the ancestor of *Limo tuberosus*, Rumph., and *Lima* of Ceylon, and all their derivatives—*Limo agrestis*, *Limo Ferus*, *Limonellus aurarius*, and those figured in tab. 28 & 29, all of Rumphius; and also the ancestor, more distantly, of all our other cultivated true Limes of India, Ceylon, and other parts. In my opinion, the reason why the Lime has so persistently a winged petiole, is the immense winged petiole of its progenitor, *Citrus Hystrix*, it being too prominent a feature to be obliterated by cultivation. If this be not conceded, at all events it will be allowed that the true Lime, the *C. acida* of Roxb., is a nearer relative of *C. Hystrix* than of *C. medica*.

Remarks on some Fossil Leaves from the Isle of Mull (Scotland). By J. Starkie Gardner, F.L.S., F.G.S.

[Read 21st January, 1886.]

The series of plants is not very extensive, but many of the specimens are in remarkable preservation, and being in a hard matrix are quite beyond the risk of injury.

The flora comprises but one Fern, and that is indistinguishable from the living *Onoclea sensibilis* of Western America and Eastern Asia. It is represented by both fertile and barren fronds, and though very limited in range, is extraordinarily abundant in individuals. With it is an *Equisetum*; but the most careful search failed to bring any other Cryptogamous plants to light.

The Coniferæ are better represented. A *Ginkgo* is indistinguishable from the existing species, and is more abundant and luxuriant in this locality than in any other. In those remote times it seems to have formed a circumpolar belt such as Firs and Larches do at the present day, and must have been well-nigh universal in northern regions. Geological changes, such as the intrusion of sea and desert, changes of climate, and the competition of stronger forms, have been peculiarly fatal to it. The type of *Podocarpus* represented at Mull has a wider distribution at the present day. The *Taxus* was formerly supposed to be a *Sequoia*, but it does not agree in any of its minuter characters with the surviving Redwood, the foliage of which also breaks up in quite a different way. There are, moreover, no *Sequoia*-cones associated with it; but it does, on the other hand, agree in every respect with an existing Yew of Japan. The determination of the *Cryptomeria* rests on its identity with a species found in the somewhat newer beds of Antrim, with which *Cryptomeria*-cones are abundantly associated. All these I have described in the volume of the Palæontographical Society which is on the eve of publication.

Monocotyledons are only represented by one sword-shaped leaf with rectangular netted venation.

I have not yet made any attempt to determine the Dicotyledons, except by comparing them with other fossils.

Three very well known Arctic Tertiary species are the most abundant, and these have been named *Platanus*, *Corylus*, and *Grewia*. For the present I can only regard them as of geo-

logical, and not botanical value. With regard to the supposed *Platanus*, it is quite unlike the real *Platanus* in form, texture, and venation, and perhaps more like some Cretaceous leaves known as *Credneria* and *Protophyllum*. There is no reason to doubt, however, that true *Platanus* was already in existence at this period, as it has been found in our lower Eocenes in England, and in still older rocks in America. A curious burr-like fruit, perhaps belonging to one or other of these species, is not uncommon. There are about twenty species of Dicotyledons in all, but I believe that further search will greatly increase the number.

The differences between this flora and those of the County Antrim, which are included in the same Basaltic flows, though on a higher level, are very remarkable. There must have been a considerable lapse of time between them, but the difference is too great to be altogether accounted for in this way. Forests disappear at times with great rapidity, and the arrival of new and vigorous species will sometimes exterminate the indigenous trees. There is the well-known instance in Denmark of the Beech killing off the Birch, the Oak, and the Fir. A change in the flora does not therefore necessarily imply a fresh geological period.

There is another and perhaps more ingenious way of accounting for the change. The enormous flows of basalt must have been continually substituting a Laterite formation with a rich and ferruginous soil for the previous gneiss and limestone, and this we may assume would lead to a considerable change in the character of the forests *. A flora may be produced in a sheltered spot of quite different aspect from the average flora of a locality. Thus no one wandering over the Isle of Mull would suppose that in Bute Island, in almost the same latitude, there are

* As an example of this I may quote from Mr. Kurz, in his preliminary Report on the Forest and other Vegetation of Pegu. "No other formation except metamorphic and volcanic ones, can boast of such a variety of species, in spite of its apparent sterility, as Laterite. It is this rock that affects vegetation so much that the great difference between the floras of Malacca, Borneo, Sumatra, &c., on the one hand, and that of Java, on the other side, is produced. It is also this formation which allows so many Australian genera, like *Melaleuca*, *Bæckea*, *Tristania*, *Leucopogon*, &c., to spread so far to the north-west, some of which, like *Tristania*, spread as far north as the Ava frontier. If all the Laterite plants were to be erased from a list of the plants of Pegu proper, the flora would be rendered very uninteresting indeed."

luxuriant woods in which the *Arbutus* flourishes and ripens its fruit.

The Mull flora is interesting as supplying fresh confirmation to the view, first propounded by Asa Gray, that formerly the entire northern temperate regions possessed a very uniform flora. It was not previously demonstrated that the Greenland and North-American Tertiary flora extended to Europe in Eocene times. Its final disappearance from Europe was doubtless due to the causes enumerated by Asa Gray during a Glacial period; but there must also have been numberless minor migrations and changes that will be found to have given local colouring to fossil floras, as these are successively brought to light. The flora will acquire a far higher interest when the plants have been studied. The difficulties in determining them are well known, but I trust that care and perseverance will prove them not to be insurmountable. Work in our own country will at best but afford us glimpses of the past. The data in regard to the former inhabitants of the land are incomplete and must ever remain so, but we must not undervalue them on that account. If we really wish to investigate the origin of the existing vegetation of the north temperate world, we shall have to examine the enormous series of plant-deposits in Spitzbergen, which attain a thickness of some 3000 feet, and were apparently being deposited continuously throughout that critical period when existing dicotyledonous genera were taking shape. If a small vessel could be despatched on an expedition to Spitzbergen and Greenland, the results of a single summer's collecting would, I believe, far surpass our highest anticipations.

I desire to express in conclusion my great acknowledgments to the Duke of Argyll, on whose property the "Leaf Beds" are situated, for assistance rendered, both personally and through his agents; nor must it be forgotten that we might still have been in ignorance of their existence had he not brought them into notice.

On a Collection of Ferns made in North Borneo by the Bishop of Singapore and Sarawak. By J. G. Baker, F.R.S., F.L.S.

[Read 4th March, 1886.]

(Plates XI. & XII.)

Dr. G. F. Hose, Bishop of Singapore and Sarawak, has just sent home a beautifully dried and carefully annotated series of Ferns from the north of Borneo, collected principally in the neighbourhood of Sarawak. The following is a complete enumeration of the species, with descriptions of the novelties. Besides scattered notices, three papers have been published on the Ferns of the island, viz.:—1. Cesati's memoir in vol. vii. of the 'Atti della R. Accademia delle Scienze Fisiche e Matematiche di Napoli,' founded mainly on the material collected by Dr. Beccari; 2, my own report in vol. viii. p. 37 (1870) of the 'Journal of Botany,' on the collection of Mr. F. W. Burbidge; and 3, Burck's paper in vol. iv. of the 'Annals of the Botanic Garden of Buitenzorg,' p. 88 (1884). Of the numbers used, those given for every species are Dr. Hose's collecting-numbers; and those given for the novelties within brackets indicate the position they occupy in the series followed in our 'Synopsis Filicum.'

2. Gleichenia flagellaris, *Spreng.*

1. G. vestita, *Blume.* Matang, 3000 feet. Seems conspecific with *G. hirta*, Blume.

4. Cyathea Brunonis, *Wall.* Caudex 2 feet long.

5. Hemitelia alternans, *Hook.* As Dr. Hose points out, and as his specimens clearly show, this has a rudimentary involucre. I believe now that *Cyathea Lobbiana*, Hook., is the same species.

6. Alsophila latebrosa, *Hook.* Caudex 8–10 feet long. Stipe unarmed.

7. A. Burbidgei, *Baker.*

9. A. ramispina, *Hook.* Matang, 3000 feet. Only gathered before by Lobb long ago.

10. A. contaminans, *Wall.* Caudex 12 feet or more long. Stipe muricated.

14. Hymenophyllum dilatatum, *Sw.* Matang, 2000 feet.

15. H. Neesii, *Hook.*

22. H. JAVANICUM, *Spreng.*

17. TRICHOMANES SAXIFRAGOIDES, *Presl.* Cannot, I think, be separated specifically from *T. parvulum.*

16. (61*) T. HOSEI, *Baker*, n. sp.; rhizomate filiformi late repente, stipite brevi nudo haud alato, frondibus parvis ovato-rhomboideis tripinnatis, pinnis inferioribus maximis deltoideis basi postice cuneato-truncatis, segmentis ultimis linearibus uninerviis integris ascendentibus, soris terminalibus solitariis, involucro infundibulari angusto alato labiis 2 parvis semiorbicularibus prædito, receptaculo breviter exserto. (Plate XII.)

A small finely-cut species allied to the Philippine *T. brevipes*, Baker, and *T. Smithii*, Hook., and Polynesian *T. tenue*, Brock. Fronds about 2 inches long, ½ inch stipe included, erect, spaced out upon the long filiform rhizome. Final one-nerved entire segments about ⅓ of a line broad, not more than $\frac{1}{8}$–$\frac{1}{6}$ in. long. Involucre ⅛ in. long, narrowly winged on both sides nearly or quite to the top of the tube.

25. T. MAXIMUM, *Blume.*

23. T. FŒNICULACEUM, *Bory.* Matang.

12. (18*) DICKSONIA (§ PATANIA) AMPLA, *Baker*, n. sp.; rhizomate repente paleaceo, frondibus amplis deltoideis glabris tripinnatis, pinnis oblongo-lanceolatis, pinnulis lanceolatis multijugis acuminatis ad costam vel alam angustam pinnatipartitis, segmentis ultimis adnatis oblongis parallelis contiguis, venis copiose pinnatis venulis 6–8-jugis erecto-patentibus, soris parvis globosis marginalibus incurvatis, involucri valva exteriori majori glabra semiorbiculari.

A very distinct species, allied to the Tropical-American *D. adiantoides*, H. B. K. Rhizome epigæous, creeping, as thick as a man's finger, clothed with dark paleæ. Fronds 4 feet or more long, moderately firm in texture. Rhachis brown, unarmed, pubescent only down the channelled face. Lower pinnæ the largest, 2–3 feet long, nearly a foot broad. Tertiary segments $\frac{1}{6}$ in. broad. Sori placed on the edge of the tertiary segments, principally near the base. Veins 7–8 on a side in the tertiary segments, the lower forked, the upper simple.

11. (23*) D. (§ PATANIA) GOMPHOPHYLLA, *Baker*, n. sp.; frondibus amplis glabris deltoideis decompositis, rachibus inermibus, pinnis infimis maximis deltoideis inæquilateralibus,

pinnulis oblongo-lanceolatis, segmentis tertiariis multijugis oblongis, quaternariis multijugis subsessilibus inæqualiter cuneatis parvis obtusis profunde pinnatifidis, venis subflabellatis, soris parvis globosis incurvatis, involucri valva exteriori majori semiorbiculari.

Matang, Sarawak, 2000 feet.

A very large decompound species with the habit of *D. moluccana*, Blume, and *D. scandens*, Blume, but the rhachises unarmed. Primary rhachis half an inch thick at the base of the lamina. Lower pinnæ $1\frac{1}{2}$–2 feet long, a foot broad. Quaternary segments not more than $\frac{1}{4}$ inch long, parallel with the rhachis on the upper side at the base, cut away on the lower side. Sori small, placed at the base of the sinuses of the quaternary segments.

28. Davallia parallela, *Wall.*

29. D. alpina, *Blume.*

35. D. pinnata, *Cav.*, var. luzonica, *Hook.* Matang, Sarawak, 3000 feet.

32. D. solida, *Smith.*

39. Lindsaya cultrata, *Sw.*

40. L. cultrata, var. Lobbiana, *Hook.*

41. L. scandens, *Hook.* Known previously only as a simply pinnate type; but Dr. Hose's specimens are bipinnate, with a habit like *L. trapeziformis.*

46. L. lanuginosa, *Wall.*

47. L. divergens, *Wall.*

51. Adiantum Capillus-veneris, *L.* Kudat.

53. Pteris longifolia, *L.*

54. P. ensiformis, *Burm.*

56. P. quadriaurita, *Retz.*

57. P. quadriaurita, var. digitata, *Baker.*

59. P. incisa, *Thunb.*, var. aurita, *Blume.*

61. Blechnum orientale, *Linn.* The type and a copiously bipinnate form, gathered also by Burbidge.

62. B. Finlaysonianum, *Wall.*

64. Asplenium macrophyllum, *Sw.* A very dwarf slightly compound form.

66. A. hirtum, *Kaulf.*

67. Asplenium nitidum, *Sw.* "Stipe and rhachis always black in Borneo."

68. A. subaquatile, *Cesati.* Discovered by Beccari, and also collected by Burbidge.

69. A. porphyrorachis, *Baker.* Sarawak and Perak.

72. (205*) A. (§ Diplazium) æquibasale, *Baker*, n. sp.; caudice erecto, stipitibus cæspitosis basi paleaceis, frondibus oblongis glabris simpliciter pinnatis, pinnis 9–11 adnatis lanceolatis acuminatis crenulatis ad basin integram æquilateraliter attenuatis, venis perspicuis erecto-patentibus simplicibus vel furcatis, soris medialibus parallelis, involucro angusto glabro persistente.

River-banks at Sarawak.

Allied to *A. pallidum*, Blume, and *A. porrectum*, Wall. Texture rather thin. Both surfaces bright green, and free from hairs and paleæ. Stipe 3–4 in. long, with a few black lanceolate spreading paleæ near the base. Lamina 6–8 in. long, 4–5 in. broad. Pinnæ alternate, distant, ½ inch broad at the middle. Sori just falling short of the midrib and margin.

76. A. polypodioides, *Mett.*

74, 75, 77, 78. Forms of the very variable Asplenium maximum, *Don.*

79, 80. A. cordifolium, *Mett.* Type and a form connecting it with var. *integrifolium.*

81, 82, 83. A. lineolatum, *Mett.*

84. Didymochlæna polycarpa, *Baker.*

85. Aspidium semicordatum, *Sw.*

87, 88. A. aristatum, *Sw.*

89. A. platanifolium, *Mett.*

90. Nephrodium immersum, *Hook.*

91. N. calcaratum, *Hook.*, var. falcilobum, *Hook.*

94. N. crassifolium, *Hook.*

95. (131*) N. (§ Lastrea) sarawakense, *Baker*, n. sp.; caudice erecto, stipitibus cæspitosis semipedalibus ad apicem paleis setosis squarrosis præditis, frondibus submembranaceis ovato-lanceolatis subpedalibus tripinnatis dorso ad costas parce paleaceis, pinnis infimis maximis inæquilateraliter deltoideis postice

productis breviter petiolatis, pinnulis multijugis oblongo-lanceolatis infimis solum pinnatis, segmentis tertiariis adnatis contiguis integris, venis pinnatis, venulis paucijugis erecto-patentibus infimis furcatis, soris parvis medialibus, indusio parvo deciduo.

Sarawak.

Allied to the South-Indian *N. scabrosum* and *pulvinuliferum*. Stipes and main rhachis clothed throughout with small squarrose rigid dark-brown paleæ. Frond thin in texture, green on both sides, obscurely pubescent on the rhachises and main veins, about a foot long, 3½–4 inches broad at the base. Only the lowest pinnæ opposite and deltoid, the others alternate, sessile, and oblong-lanceolate, with divisions of pinnules not reaching down far. Largest tertiary segments ¼ inch long, ⅛ inch broad, with about 4 veins on each side.

86. (131*) Nephrodium (§ Lastrea) aciculatum, *Baker*, n. sp.; stipitibus elongatis ubique cum rhachibus paleis brunneis subulatis patulis vel squarrosis dense vestitis, frondibus magnis oblongo-deltoideis firmulis glabris tripinnatis, pinnis infimis maximis inæquilateraliter deltoideis postice productis, pinnulis multijugis lanceolatis profunde pinnatifidis vel basi pinnatis, segmentis tertiariis oblongis obtusis integris contiguis, venis pinnatis, venulis 6–8-jugis erecto-patentibus immersis obscuris, soris parvis subcostularibus, indusio parvo membranaceo deciduo.

Matang, Sarawak, 2000 feet.

Allied to the Indian *N. scabrosum* and *intermedium*. Stipes 1–1½ foot long, densely beset throughout, like the rhachises, with squarrose or spreading subulate brown paleæ. Lamina moderately firm in texture, about 2 feet long by a foot broad. Lower pinnæ much the largest, and the pinnules of the lower side much the longest. Ultimate segments ⅙ inch broad, reaching ¾–1 inch long. Sori many to a final segment, placed near the midrib on the base of the obscure veinlets.

97. N. setigerum, *Baker*.

98. (139*) N. (§ Lastrea) multisetum, *Baker*, n. sp.; stipitibus cæspitosis elongatis pallidis cum rhachibus ubique paleis subulatis rigidulis castaneis patulis vel squarrosis dense vestitis, frondibus magnis deltoideis decompositis dorso setis hyalinis sparsis præditis, pinnis oblongo-lanceolatis pedalibus vel sesquipedalibus, pinnulis multijugis lanceolatis copiose pinnatis, seg-

mentis tertiariis adnatis lineari-oblongis profunde pinnatifidis, segmentis ultimis parvis deltoideis, soris minutis medialibus, indusio membranaceo deciduo.

Matang, Sarawak, 2000 feet.

Habit of *Nephrodium setigerum* and *Polypodium ornatum*, Wall., but the stipes and rhachises everywhere densely beset with spreading or squarrose bristly paleæ. Frond 4 feet long. Pinnæ patent, the lower 1½ foot long, 4–6 inches broad. Pinnules patent, ½–¾ inch broad, the largest with 12–15 adnate distinct deeply pinnatifid segments on a side below the pinnatifid apex. Tertiary segments 1/12 inch broad. Veins forked in the largest final segments. Sori minute, not more than 1–2 in a final segment.

96. (141*) NEPHRODIUM (§ LASTREA) MEGAPHYLLUM, *Baker*, n. sp.; caudice decumbente, stipitibus elongatis basi paleis castaneis dense vestitis, frondibus magnis deltoideis glabris tripinnatis, pinnis infimis maximis inæquilateraliter oblongo-lanceolatis postice productis, pinnulis oblongo-lanceolatis acutis basi pinnatis, segmentis tertiariis oblongis obtusis infimis leviter pinnatifidis, venis in segmentis quaternariis pinnatis venulis paucijugis simplicibus erecto-patentibus, soris parvis medialibus, indusio membranacco deciduo.

Sarawak.

A huge species, most resembling in habit the glabrous forms of the Tropical-American *N. villosum*. Lower pinnæ 1½–2 feet long, 7–8 inches broad. Largest tertiary segments ½–¾ inch long by half as broad, crenate or shallowly pinnatifid. Veins pinnate opposite the quaternary lobes, with not more than two veinlets on a side. Sori 10–12 to a pinnule, one to each final lobe.

105, 120, 176. N. LEUZEANUM, *Hook.*

100. N. PROCURRENS, *Baker.*

104. N. TRUNCATUM, *Presl.*

103. N. FEROX, *Moore.*

107. N. (§ SAGENIA) TERNATUM, *Baker.* The type and a 5-lobed form.

110. (219*) N. (§ SAGENIA) STENOPHYLLUM, *Baker*, n. sp.; stipitibus gracilibus cæspitosis nudis castaneis, frondibus parvis deltoideis glabris bis tripartitis, segmentis linearibus integris acuminatis, venis in areolas hexagonas copiose anastomosantibus,

soris in segmentis subbiserialibus, indusio magno glabro persistente. (Plate XI.)

River-banks, Sarawak.

A remarkable plant, like nothing else that is known except *N. nudum*, Baker in Journ. Bot. 1879, p. 41, one of Burbidge's discoveries. Stipes 4–5 inches long. Frond 4–5 inches long and broad, consisting of three subequal thirds, each made up of three linear segments, which are each 2–3 inches long, $\frac{1}{4}$ inch broad at the middle, and taper gradually to the base and acuminate apex. Veins all faint and indistinct. Sori in a single irregular row between the midrib and edge of the segments.

111. NEPHRODIUM ACUTA, *Presl.*

113. OLEANDRA NERIIFOLIA, *Cav.*

112. O. NERIIFOLIA, var. PHYLLARTHRON, *Kunze.*

119. POLYPODIUM DIFFORME, *Blume.*

115. P. MINIMUM, *Baker.* Matang, Sarawak. One of Burbidge's discoveries.

114. P. FLABELLINERVIUM, *Baker.* Lingga mountain, Sarawak, 4000 feet. A very distinct species, gathered before only by Dr. Beccari.

116. P. ALTERNIDENS, *Cesàti.*

117. P. REPANDULUM, *Mett.* Matang, Sarawak, 2000 feet.

124. P. NUMMULARIFOLIUM, *Mett.*

126. P. SORIDENS, *Hook.* Matang, 3000 feet.

125. (311*) P. (§ PHYMATODES) SARAWAKENSE, *Baker*, n. sp.; rhizomate gracili longe repente ramoso calvato, frondibus parvis simplicibus subcoriaceis glabris oblongo-lanceolatis acuminatis basi cuneatis, venis omnibus subtilibus immersis occultis in areolas hexagonas anastomosantibus, soris magnis sparsis globosis leviter immersis.

Matang, Sarawak. Gathered previously by Lobb, but never described.

Allied to *P. superficiale*, Blume, and *P. normale* var. *sumatranum*, Baker. Rhizome, in Dr. Hose's specimen, nearly a foot long, less than a line in diameter, bearing 4 distant erect fronds, on stipes $1\frac{1}{2}$–3 inches long. Frond 4–6 inches long, $1\frac{1}{4}$–$1\frac{1}{2}$ inch broad at the middle, narrowed gradually to the base and acumi-

nate apex. Sori $\frac{1}{12}$ inch diam., scattered irregularly all over the under surface of the frond except the apex.

127. (331*) POLYPODIUM (§PLEURIDIUM) CAMPYLONEUROIDES, *Baker*, n. sp.; rhizomate gracili, epigæo late repente paleis parvis lanceolatis adpressis vestito, stipitibus brevibus erectis, frondibus simplicibus membranaceis glabris parvis oblanceolatis obtusis e medio ad basin sensim attenuatis, venis primariis subtilibus erecto-patentibus parallelis, intermediis transversalibus areolas subquadratas formantibus, soris 3–4 inter costam et marginem dispositis inter venas primarias uniseriatis.

Matang, Sarawak, 2000 feet.

Allied to *P. Melleri* and the New-Caledonian *P. selligueoides*. Rhizome cylindrical, dark green, about $\frac{1}{12}$ inch diameter. Stipes erect, naked, $\frac{1}{2}$–$1\frac{1}{2}$ inch long. Frond 4–6 inches long, $\frac{1}{2}$–$\frac{3}{4}$ inch broad, narrowed gradually from the middle to the base. Main veins fine and indistinct, the cross ones almost as regular as in the American Campyloneurons.

130. P. RUPESTRE, *Blume*. I do not think this and *P. triquetrum* can safely be kept up as distinct species.

129. (334*) P. (§ PLEURIDIUM) LEUCOPHORUM, *Baker*, n. sp.; rhizomate gracili glauco, epigæo longe repente paleis filiformibus brunneis subpatulis deciduis instructo, stipitibus brevissimis erectis, frondibus simplicibus rigide coriaceis oblongo-lanceolatis acuminatis facie glabris lucidulis viridibus punctis albis cretaceis minutis præditis, margine recurvato crebre cretaceo-punctato, dorso obscure viridibus impunctatis tenuiter pilosis, venis primariis subtilibus rectis erecto-patentibus parallelis, venulis intermediis irregulariter anastomosantibus, soris minutis superficialibus inter venas primarias irregulariter biseriatis.

Matang, Sarawak.

A very distinct and well-marked species, remarkable for the white cretaceous dots scattered over the upper surface and forming a close row on the incurved margin of the frond. Rhizome creeping to a length of a foot or more, the shining filiform paleæ $\frac{1}{4}$ inch long. Stipes not more than $\frac{1}{2}$–$\frac{3}{4}$ inch long. Frond 6–9 inches long, 1–$1\frac{1}{4}$ inch broad at the middle.

131. P. IRIOIDES, *Lam.*

132. P. MUSÆFOLIUM, *Blume*.

135. POLYPODIUM INCURVATUM, *Blume.* Matang, 3000 feet.

137. P. DILATATUM, *Wall.*, var. GRANDIDENTATUM, *Cesati.* Differs from the type by its repand pinnæ; and may be a distinct species.

144. GYMNOGRAMME QUINATA, *Hook.*

142. G. LOBBIANA, *Hook.*

141. G. BORNEENSIS, *Hook.*

140. G. BORNEENSIS, var. MAJOR, *Baker.*

148. MENISCIUM TRIPHYLLUM, *Sw.*

160. (4*) M. HOSEI, *Baker*, n. sp.; rhizomate breviter repente, stipitibus contiguis gracilibus stramineis cum rhachibus obscure pubescentibus sterilibus brevibus fertilibus elongatis, frondibus oblongo-lanceolatis glabris simpliciter pinnatis, pinnis lateralibus 7–8-jugis lanceolatis sessilibus basi auriculatis, venulis 2–3-jugis valde ascendentibus, soris demum confluentibus.

River-banks, Sarawak.

Closely allied to the Ceylonese *M. Thwaitesii.* Stipe of sterile fronds 2–6 inches long, of the fertile much longer. Fronds about $\frac{1}{2}$ foot long, $2\frac{1}{2}$–3 inches broad. Pinnæ $\frac{1}{4}$–$\frac{1}{3}$ inch broad, entire or obscurely crenulate, auricled on one or both sides at the truncate base. Pinnæ of the fertile frond at most about an inch long, $\frac{1}{6}$ inch broad.

153. VITTARIA SULCATA, *Kuhn.*

150. ANTROPHYUM PARVULUM, *Blume.*

157. DRYMOGLOSSUM PILOSELLOIDES, *Presl.*

158. (71*) ACROSTICHUM (§ POLYBOTRYA) STENOSEMIOIDES, *Baker*, n. sp.; stipitibus elongatis castaneis deorsum paleis paucis lanceolatis præditis, frondibus sterilibus oblongo-lanceolatis bipinnatifidis submembranaceis glabris margine paleis paucis hyalinis deciduis instructis, pinnis sessilibus lanceolatis multijugis ad costam late alatam pinnatifidis, segmentis secundariis oblongis obtusis, venis liberis in segmentis secundariis pinnatis, venulis 6–8-jugis inferioribus furcatis superioribus simplicibus, frondibus fertilibus consimilibus stipitibus longioribus pinnis laxioribus minoribus.

Matang, Sarawak, 2000 feet.

A very distinct species, most like *A. repandum*, var. *Quoyanum* in habit, but the veins entirely free. Stipe of the barren frond a

foot long, of the fertile nearly 2 feet. Barren frond 1–1½ foot long, 7–8 inches broad. Lower pinnæ 4–4½ inches long, 1–1¼ inch broad. Secondary segments $\frac{1}{6}$–$\frac{1}{5}$ inch broad.

159. (108*) Acrostichum (§ Chrysodium) modestum, *Baker*, n. sp.; rhizomate gracili late repente paleis parvis lanceolatis apice prædito, stipitibus gracillimis elongatis, frondibus sterilibus simplicibus linearibus integris acuminatis glabris, venis omnibus in areolis hexagonis anastomosantibus, frondibus fertilibus consimilibus sed minoribus.

River-banks, Sarawak.

A small inconspicuous plant, most like the Ceylonese *A. Wallii*, Baker. Rhizome trailing to a length of half a foot, the fronds spaced out upon it. Stipe of sterile frond 2–3 inches long Lamina 4–6 inches long, $\frac{1}{4}$–$\frac{1}{3}$ inch broad at the middle, tapering gradually to the base and acuminate apex. Fertile frond 2–3 nches long, $\frac{1}{6}$ inch broad.

162. (110*) A. (§ Chrysodium) antrophyoides, *Baker*, n. sp.; rhizomate breviter repente, frondibus sterilibus subcoriaceis glabris sessilibus oblanceolatis acutis basi rotundatis, venis immersis occultis omnibus in areolis parvis anastomosantibus, frondibus fertilibus linearibus rigidis dimidio superiori soriferis deorsum ad alam angustam costularem nudam attenuatis.

Matang, Sarawak.

A very distinct species, with sterile fronds most resembling those of *Antrophyum subsessile.* Barren fronds 6–8 inches long, ¾–1 inch broad; fertile 8–9 inches long, $\frac{1}{8}$–$\frac{1}{6}$ inch broad.

161. A. quercifolium, *Retz.*

163. A. bicuspe, *Hook.*, type and var. *integrifolium.* Sarawak, mountains at 4000 feet. "Only a few of the barren fronds forked."

164. A. aureum, *L.*

165. A. spicatum, *L.*

171. Lygodium scandens, *Sw.*

172. Angiopteris evecta, *Hoffm.*

173. Ophioglossum reticulatum, *L.*

175. Helminthostachys zeylanica, *Hook.*

DESCRIPTION OF THE PLATES.

PLATE XI.

Nephrodium (§ *Sagenia*) *stenophyllum*, Baker, n. sp.—Fig. 1. Frond. Fig. 2. Enlarged portion, showing sori.

PLATE XII.

Trichomanes Hosei, Baker, n. sp.—Fig. 1. Frond. Fig. 2. Enlargement of thecæ.

On the Freshwater Hydrocharideæ of Africa and its Islands.

By H. N. RIDLEY, M.A., F.L.S.

[Read 1st April, 1886.]

(PLATES XIII. & XIV.)

OF the eleven genera of Hydrocharideæ inhabiting fresh water, seven occur in Africa and the adjacent archipelago. The section Hydrilleæ is represented by the genus *Hydrilla* and *Lagarosiphon*. The former genus consists of a single polymorphic species, very widely distributed and common throughout Tropical Asia, and occurring also in Australasia; it is found in Africa, but is apparently not so abundant. *Lagarosiphon* is a genus very characteristic of Africa, all the species known being natives of that region or of Madagascar, with the single exception of *L. Roxburghii*, an Indian plant of very different habit, which has, however, been found in Socotra, but there it is possibly an introduction. The species are all very closely allied, and not easy to study from dry specimens, as the flowers are exceedingly delicate and the male flowers are comparatively rarely met with. One of the chief distinctions between *Hydrilla* and *Lagarosiphon* is that the leaves in the former are in whorls, in the latter scattered; in some species of *Lagarosiphon*, however, there is a great tendency for the leaves to become opposite, especially towards the apex of the stems. This is notably the case in *L. rubella*, mihi. In the 'Genera Plantarum' it is stated that there are no staminodia in the female flower; this is usually the case, but they do occur in at least one species in the form of slender short filaments.

The Vallisneriæ consist of three small genera, two of which occur within the area. One, *Vallisneria*, comprises a single species widely spread over the whole world. *Blyxa* contains the common Indian plant, *B. Roxburghii*, Rich., which is found also

in Madagascar, and an undescribed species, *B. radicans*, mihi, from Angola. The Stratioteæ are well represented by a number of species of *Ottelia* and *Boottia*.

Only two of these genera are common to both the Old and New World, viz. *Vallisneria* and *Ottelia*, and of the latter but a single species occurs in the New World, viz. *O. brasiliensis* in Brazil. None of the genera are endemic to Africa, but all occur more or less widely throughout Tropical Asia. Five of the African species are natives also of Asia, viz. *Hydrilla verticillata*, Casp., *Blyxa Roxburghii*, Rich., *Lagarosiphon Roxburghii*, Benth., *Ottelia alismoides*, Pers., *Boottia cordata*, Lindl.; and it is very interesting to note that all these species are, as far as at present known, confined to Eastern Africa, the islands of Madagascar and Mauritius. From this it may be conjectured that the Hydrocharideæ pushed their way into Africa from the East, perhaps, for the most part, after the separation of the continents of Africa and America was complete. At the same time it is possible that some of these plants may have been introduced into the country in rice-cultivation.

HYDRILLEÆ.

LAGAROSIPHON MUSCOIDES, *Harvey*, *Hook. Journ. Bot.* iv. p. 230, t. 22.

Cape of Good Hope, *Harvey* 1187; *Zeyher* 1732!; *Drège* 2276 *b c*!

Var. MAJOR, n. var. Planta validula, habitu *Hydrillæ verticillatæ*. Folia crassa atro-viridia opaca, $\frac{3}{4}$ unciam longa, $\frac{1}{12}$–$\frac{1}{6}$ lata, costa obscura; dentes breves obtusiores basi dilatati circiter 70 in utraque margine; margines pallidæ folii angustissimæ; spatha floris feminei ferme $\frac{1}{4}$ unciam longa, dentibus paucis obtusis brevibus; spatha mascula $\frac{1}{3}$ unciam longa.

South Africa, Undezine River, Victoria, *Cooper* 17! Transvaal, Hoggeveld, Bronkerspruit, no. 6559! and Trigardsfontein, 6678! *Dr. Rehmann.* Herb. Brit. Mus.

This variety, though looking very distinct, seems to be only a remarkably large and coarse form. It has the habit and texture of *Hydrilla*. The leaves are so thick as to be almost opaque under the microscope, instead of thin and transparent as in the well-known form, so that the midrib is quite obscured. The teeth also are shorter and blunter, slightly thickened at the base. The spathes, although quite similar in form, are much larger.

L. cordofanus, *Caspary in Pringsh. Jahrb.* i. p. 503.—Arasch Cool, Nubia, *Kotschy* no. 170! Herb. Brit. Mus.

L. Nyassæ, n. sp. Planta tenuis bryoides; caules tenuissimi; folia lineari-lanceolata acuta læte viridia, 1 cm. longa, 3 mm. lata; dentes in utraque margine 26–33, longiusculi subappressi; flores feminei minutissimi; petala lanceolata obtusa; styli graciles ad dimidium longitudinis in stigmatibus fissi; ovarium subelongatum conicum; tubus perianthii unciam longus capillaceus; spatha lanceolata edentula subintegra.

Lake Nyassa, *Dr. Laws*! Herb. Brit. Mus.

I have seen only female flowers of this species. It is a smaller and more delicate plant than any of the other species, and the lanceolate petals and deeply cleft style, with the simple entire spathe, sufficiently distinguish it.

L. Steudneri, *Caspary in Schweinfurth's Beiträge Flora Æthiop.* p. 200, t. 4.—Wadela, East Abyssinia, *Steudner*.

L. rubella, n. sp. Caules 3–5 pedes longi, purpurascentes graciles; folia remotiuscula subopposita, linearia acuminata, 7 mm. longa, $\frac{1}{3}$ mm. lata, herbaceo-viridia; dentes circiter 30 in utraque margine, breves; internodi nonnunquam 1 cm. longi: flores feminei minuti rubelli, bractea pallida ad basin ovata obtusa quam fructus brevior, dentibus 10 in utraque margine dissitis, spatha integra edentula; tubus perianthii perlongus, 3 cm., gracillimus; petala ovata rotundata obtusissima; styli crassiusculi, breviter bifidi, trichomata stigmatica brevia; ovarium elongatum ellipticum conicum; capsula 5 mm. longa; semina 3 elongata fusiformia, 3 mm. longa: flores masculi, spatha brevis obconica quadrata $\frac{1}{6}$ unciam longa; stamina plura.

Angola, Huilla, frequens in flumine Humpatensi, socialis cum *Utriculariis* et *Potamogetonis* speciebus, *Welwitsch* no. 6472! Herb. Brit. Mus.

This is a lax species, chiefly remarkable for the more distant leaves and the purplish flowers. It, to some extent, resembles *L. Steudneri*, Casp., but has fewer teeth to the leaves, and the petals are broader and more obtuse.

L. Schweinfurthii, *Caspary, Bot. Zeit.* 1870, p. 88.—Central Africa, in Djur land, *Schweinfurth* 2452!; Bongo land, *Schweinfurth* 2158! Herb. Kew.

L. DENSUS, n. sp. Planta densa, elongata, habitus *Naiadis indicæ*. Folia copiosa et dense congesta, atro-viridia, anguste linearia acuta, $\frac{3}{4}$ unciam longa, $\frac{3}{4}$ mm. lata; dentes 45–50 in utraque margine, longiusculi subbappressi, versus apicem folii copiosiores; flores minuti; petala et sepala ovata obtusa; stigmata subclavata crassiuscula breviter fissa; staminum rudimenta tria tenuia; ovarium obconicum; perianthii tubus gracilis capillaceus, $\frac{1}{2}$ unciam longus vel ultra; bractea lanceolata longe acuminata abrupte obtusa, profunde fissa edentata; capsula elliptica 4 mm. longa.

Madagascar, Imerina, *Hildebrandt* 3804! Herb. Brit. Mus.

A dense, compact, dark green plant, with very numerous leaves. The female flowers are all that I have seen. The stigmata much resemble those of *L. Steudneri*, Casp. The rudimentary anthers are fairly large and conspicuous, and the perianth-lobes are ovate and obtuse. The bract subtending the ovary is very deeply cleft, the laciniæ being rather narrow and acuminate and longer than the ovary.

L. MADAGASCARIENSIS, *Caspary in Rel. Rutenb.* ii. p. 252, t. 18.—Madagascar. Prope Marovay: flowers white; May 1880—*Hildebrandt* no. 3422! Herb. Brit. Mus., Kew.

Hildebrandt's plant, which I take to be the species described by Caspary, is a laxer, shorter-leaved plant than the preceding. The leaves in the upper part of the stems are often no more than 5 mm. long and $\frac{1}{2}$ broad, somewhat recurved, bright green when moistened, and with a very distinct midrib. The leaf-buds and the adjacent leaves are frequently purplish. The spathe of the female flower did not appear to me to extend so far beyond the ovary as is shown in Caspary's figure, and the laciniæ in this plant were blunter. The fruit was not seen by Caspary. It is oval elliptical in outline, $\frac{1}{2}$ cm. in length. The seeds are cylindrical, with an elliptical outline, beaked at each end, longitudinally striate and dark brown; they are 1 mm. in length, and there are 4 or 5 in the capsule.

The plant has more the appearance of a *Hydrilla* than *L. densus*, on account of the shortness of the leaves, especially in the upper parts, where, too, they are almost opposite. The length of the internodes is often as much as 5 mm., which also adds to the resemblance.

Another species was obtained in Madagascar by Hildebrandt, Imerina, no. 3523, which is quite distinct from either of the other

Madagascar species, and more resembles *L. muscoides*, Harv. It is remarkable for its very spinulose leaves, the teeth of which are singularly long and numerous, and the stem is distinctly angled. Unfortunately I can find neither fruit nor flowers upon the specimens, so cannot properly describe it.

L. Roxburghii, *Benth. in Benth. & Hook. f. Gen. Pl.* iii. p. 451.—Socotra, *Boivin*! *in herb. Kew.* A letter with this specimen, from Dr. Ascherson, suggests that the plant may have been introduced into this region with rice from India.

Hydrilla verticillata, *Rich. Mém. Inst. Par.* 1811, p. 961, t. 2.—Mauritius, *Robillard*! Herb. Brit. Mus. White Nile, *Grant*! Herb. Kew.

Vallisneriæ.

Vallisneria spiralis, *Linn. Sp. Pl.* ed. i. 1015.—Deep water, Sierra Leone, *Don*!; Lagos, *Barter*!; White Nile, *Schweinfurth*!; Bahr-el-Arab, Gazelle River, *Schweinfurth*!; Lake Nyassa, *Dr. Laws*!

Apparently common in Africa, except in the south. *V. æthiopica*, Fenzl, based on a plant collected by Kotschy in Senaar, Nubia, no. 284, seems to be merely a remarkably stunted form with dentate leaves, somewhat analogous to the Australian plant called *V. nana* by Robert Brown. There is a very similar plant in the British Museum, labelled "Ind. Or., Soc. Un. Fratr.," which has also dentate edges to the leaves.

Blyxa Roxburghii, *Rich. Mém. Inst. Par.* 1811, p. 63.—Madagascar, Imerina, no. 3805! prope Marovay, no. 3443! *Hildebrandt.* Herb. Brit. Mus.

The Madagascar plant does not seem to differ in any material points from the Indian form. It does not seem to have been met with yet on the mainland of Africa.

Blyxa radicans, n. sp. (Plate XIV.) Caulis gracilis prostratus, radicans, radicibus paucis longis; folia graminea angusta linearia obtusa ad bipedalia, $\frac{1}{8}$ unciam lata, basi dilatata in vagina membranacea, plura singula dissita in caule; scapus gracilis 9-uncialis. Flores masculi: spatha biuncialis angusta subcylindrica, basi paullo dilatata; tubus quam spatha haud longior; sepala tenuia ligulata obtusa pallide virescentia, $\frac{3}{8}$ unciam longa; petalal ongiora angustiora $\frac{5}{8}$ unciam, alba; stamina sex, gracilia, linearia acuminata; pistillodia tria brevia, basi dilatata. Flores feminei: spatha sub-

similis sed tubus perianthii longe exsertus, $2\frac{1}{2}$ uncias supra spatham; sepala viridia chartacea ligulata obtusa, $\frac{5}{16}$ unciam longa; petala alba, angustissima linearia filiformia, $\frac{5}{8}$ unciam longa; styli validuli complanati tres, petalis subæqualibus; fructus carnosus longe cylindraceus.

Huilla. Frequens et gregaria in rivulo Lopollo imprimis ad Catarractam, rarius florens. Fructus immaturi cum floribus initio Maii 1860, *Welwitsch.* Herb. Brit. Mus.

This species is easily distinguished from *B. Roxburghii* by its creeping stem, which throws up distant solitary leaves sheathing at the base. At intervals the leaves appear to become crowded and the flowers are then produced. The female scape is usually shorter than the male. The spathes of each are similar and resemble in form those of the other species; but in the female flower the perianth has a long tube projecting for two inches beyond the spathe, while the perianth-tube in the male is no longer than the spathe. The sepals in the male flower are thin and transparent, while in the female they are thicker and opaque. The petals in both are thin and white, and in the female exceedingly narrow and filiform. The stamens are similar to those of the other species, only narrower and acuminate. The pollen-grains are globular and covered with short processes.

Stratioteæ.

Ottelia.

O. alismoides, *Pers. Syn. Pl.* i. p. 400.—Nubia, Egypt, *Sir Gardner Wilkinson*!, *Delisle*!; Uah-el-Behariah, *Ascherson* (*Œsterr. Bot. Zeit.* 1876); El Aguri, Lybian Desert, *Ascherson*!; Damietta, *Bromfield*!; Cordofan, *Kotschy*!

This is the most widely spread species in the genus, occurring also in India, Borneo (*Grabowsky*), Timor (*R. Brown*), Philippines (*Cuming*), Java (*Horsfield*), China, and Japan.

O. vesiculata, n. sp. Acaulis; folia lanceolata longe petiolata, lamina 3–4 uncias longa $\frac{3}{4}$ unciam lata, petioli 3-unciales; scapi 3–15-unciales, compressiusculi, breviter bialati, paullo infra spatham sensim incrassati, compresse tetragoni angulis lateralibus acute alatis; spatha vesiculatim inflata compresse lato-ovoidea extus purpureo-vittata, ore bidentato demum lacero, unciam longa, $\frac{5}{8}$ unciam lata (in sicca); sepala lanceolata subacuta $\frac{3}{8}$-uncialia; petala lutea $\frac{1}{2}$ unciam longa; stamina 6; styli 7 (*fide Welw.*); ovarium incomplete 9-loculare.

Huilla. In rivulis lente fluentibus et stagnis limpidis prope Lopollo et Mumpulla. Flores in Octobri et Decembri, etiam Aprili. Folia primum (in vivo) rigidula fragilia pellucida læte viridia, *Welwitsch* no. 6497! Herb. Brit. Mus.

O. ULVÆFOLIA, *Buchen.*—Madagascar, Imerina, *Hildebrandt*, 3803! *Hilsenberg*! *Lyall* 149! *Baron* 900! *Parker*; "Tan-Tang-hin-ranoo."

O. PLANTAGINEA, *Welw. MSS.* Caulis brevis crassus descendens, radices multas emittens; folia copiosa ovata petiolata crispa, 4 uncias longa (petiolus 1½ unciam), 2½ lata; scapi 10-unciales flaccidi; spatha saccata, uncialis, alis brevissimis, dentibus circiter 10, brevibus obtusis; floris pedicellus e spatha non productus; sepala lanceolata obtusa ⅜ unciam longa quam petala multo breviora, viridia, marginibus scariosis; petala ¾ unciam longa, flava vel lutea.

Huilla, gregaria in stagnis juxta ripas rivorum prope Catumba. Radicis fibri sub epiderme æneo-nitentes. No. 6469, *Welwitsch*! Herb. Brit. Mus.

This plant has a distinct, though short, conical descending stem, by which, together with its ovate crisped leaves and numerous teeth to the spathe, it is easily distinguished.

O. LANCIFOLIA, *Richard, Tentamen Flor. Abyss.* ii. p. 280, t. 95. —Ambaca in lacu ad sinistram fluvii Caringa. Flores et fructus Junio. No. 6466, *Welwitsch*! Herb. Brit. Mus.

Var. FLUITANS, n. var. Folia elongata angustiora longissime attenuata in petiolis, pedalia 1¼ unciam lata.

Pungo Andongo. Frequens cum *Nymphæis* in stagnis editiorum rupium Præsidii Pedrasongue ad jugum inferius. Flores medio Februario, fructus Aprili. No. 6468, *Welwitsch*! Herb. Brit. Mus.

I have little doubt as to this being the plant intended by Richard; and if so, it is a true *Ottelia* and not a *Boottia* at all, as suggested in the 'Genera Plantarum.' It exactly resembles the figure quoted, but I have not seen Abyssinian specimens. The plants referred by Mr. Baker (Trans. Linn. Soc. xxix. p. 151) to this species, which were collected by Speke and Grant and Schweinfurth, seem to me to be a species of *Boottia* allied to *B. abyssinica*, mihi. The flowers in Dr. Welwitsch's specimens were deep yellow. I suspect that the white-flowered plants obtained by Schweinfurth at Monbuttu, no. 3938, and one of those collected by Speke and Grant, are new species of this genus.

Boottia.

B. crassifolia, n. sp. Rhizoma crassum ½ unciam longum, oblique descendens radices multas emittens, squamis ovatis dense tectum; folia ligulata lorata obtusa, basi in petiolum attenuata, carnoso-subcoriacea rigida, obscure virentia, 5–7-nervia, 19 uncias longa, 2–3 uncias lata, marginibus crispulis; scapi 15-unciales; spatha subcylindrica tubulosa, 7-canaliculata, basi paullo ampliata, subcompressa, utrinque alata sex-costata, dentibus brevibus obtusissimis; sepala viridia, ½ unciam longa, ¼ lata, lanceolata obtusa; petala flava.

Angola. In stagnis profundis et rivulis Mumpulla sparse, et Lopollo. Flores et fructus Aprili, fructus etiam Octobri. *Welwitsch*, no. 6470! Herb. Brit. Mus.

The stout rhizome of this plant is covered with close-set broad and blunt sheathing-leaves, and descends somewhat obliquely into the mud; the leaves are very long and stiff, resembling to some extent the fronds of a *Laminaria*. The species is somewhat closely allied to *B. scabra*, Benth., but has not the peculiar scabridity of that species.

B. scabra, *Benth. et Hook. f. Gen. Pl.* iii. p. 454.—Ottelia scabra, *Baker*, *Trans. Linn. Soc.* xxix. 151.—Mogren el bahr, Gazelle River, *Schweinfurth* 1121! *Speke & Grant*! Herb. Kew.

B. abyssinica, n. sp. Rhizoma crassum, submersum, unciale, radices copiosas longas emittens; folia plura tenuia lanceolata petiolata obtusa elongata, 15 uncias longa, 1½ lata; scapi crassi debiles 9-unciales; spatha oblonga elliptica, apice vix attenuata, 2 uncias longa, circiter ½ lata; flores in spatha duo; sepala lanceolata obtusa coriacea, ¾ unciam longa, ⅛ lata; petala flavida visa haud multo sepala superantia.

Abyssinia. Zana prope Carrata, Dec. 1863. Schimper, iter recentius, no. 1452! Herb. Brit. Mus.

The long, narrow, thin leaves, not unlike those of *Ottelia ulvæfolia*, and the straight elliptical spathe not tapering to the apex, but almost of the same diameter throughout its length, sufficiently distinguish this plant. The rhizome, too, is not covered with large scale-leaves, as in *B. crassifolia*, but seems to resemble that of *O. plantaginea*, and is apparently deeply seated in the mud in its native haunts. The flowers are hardly open in the only specimen known to me, and the neck of the perianth barely projects out of the mouth of the spathe.

B. CORDATA, *Ldl.*—Madagascar, *Forbes* no. 1! Herb. Brit. Mus.

B. EXSERTA, n. sp. (Plate XIII.) Rhizoma subnullum; folia coriacea ovata elliptica obtusa 5-nervia longe petiolata, lamina $2\frac{1}{2}$–3–5 uncias longa, $1\frac{3}{4}$–2 uncias lata, petiolus ad 9 uncias longus; scapus 10-uncialis vel brevior; spathæ angustæ 1–2 uncias longæ, subcylindricæ vix dilatatæ apice trifidæ, latere uno profundiore fissæ; flores ♂ circiter 6 in spatha, tubus longe exsertus; sepala tenuia quam petala multo breviora; petala flava versus apices albescentia, ovata obtusa; stamina flava; flos ♀ singulus in spatha 2 uncias longa, tubus exsertus; sepala angusta coriacea viridia, acuminata, $\frac{5}{8}$ unciam longa, obtusa.

Eastern Africa. River Shire, a few miles above Shamo, Aug. 1859; R. Zambesi, Shupanga, Jan. 5, 1860, *Sir John Kirk in Herb. Kew*! Madagascar, no. 2, *Forbes*! Herb. Brit. Mus.

This is a small species with hard leaves something like those of *Potamogeton natans*, L., and rather small yellow flowers, the tubes of which project for some distance beyond the spathe. Both the specimens collected by Sir John Kirk and the drawing made by him (for the use of which I have to express my thanks to the authorities at Kew, and especially to Mr. Baker) were in male flower; but in the British-Museum herbarium are two specimens collected by Forbes in Madagascar, which have both male and female flowers. The male flowers, besides being more numerous in the spathe than the female, are larger, with a more delicate tube further exserted from the mouth of the spathe, and the sepals are quite thin and shorter and blunter. Two flowers apparently are open at the same time. The petals are yellow, deepest in the centre and passing into white at the edges. The female flower has a shorter and thicker tube, and larger thicker sepals, very narrowly lanceolate acuminate but blunt. I have not seen the petals.

DESCRIPTION OF THE PLATES.

PLATE XIII.

Boottia exserta, Ridley, n. sp.

Fig. 1. The entire male plant, nat. size, from an original drawing by Sir John Kirk, F.L.S.
2. Spathe of male plant, laid open.
3. Spathe of female flower, laid open; petals fallen away.
4. A stamen.
5. Rudimentary pistil of male flower.

PLATE XIV.

Blyxa radicans, Ridley, n. sp.

Fig. 1. Female plant, of nat. size.
2. Female flower, enlarged.
3. Male spathe, enlarged.
4. Male flower, laid open and enlarged.
5. A stamen, enlarged.
6. Pollen-grains, enlarged.

Some new Species of the Genus *Metzgeria*.

By W. MITTEN, A.L.S.

[Read 6th May, 1886.]

SINCE the publication of the monograph of this genus by Dr. Lindberg in 1877, when he distinctly separated ten species, and for the time exhausted the subject, eight species have been added by Dr. Spruce in his 'Hepaticæ Amazonicæ et Andinæ,' seven of these being from the regions he had visited and one from New Zealand. All these species are, excepting the difference in ramification and the degree of their pubescence, very uniform in their appearance, and coincide very nearly with the common *M. furcata*, which might thus well be considered the typical and representative species. The discovery, however, of a few stems recently sent from New Zealand by Mr. Reader, has revealed a form which could hardly have been anticipated, and thus leads to the conclusion that other modifications will in time be discovered, which must change the idea of the genus, and may alter its place in arrangements.

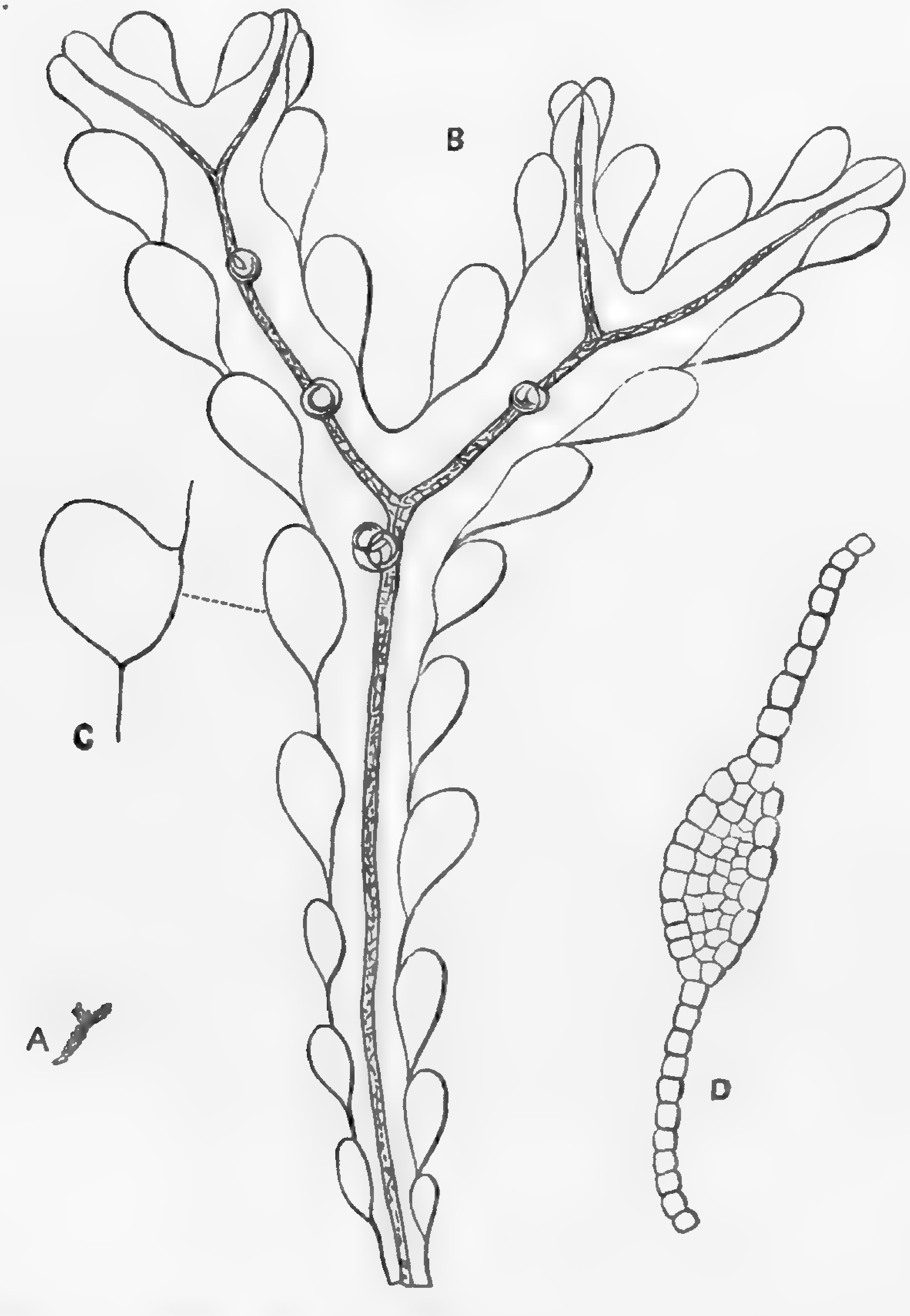
METZGERIA SACCATA, sp. n.; frons dichotome divisus, supra convexulus, lævis marginibus ubique lobis alternatim dispositis saccatis patenti-ascendentibus compressulis ad ventrem frondis incurvis.

Hab. New Zealand, on bark, with a *Frullania* and several mosses, a very few stems only; Tasmania, forests between the Gordon and Franklin rivers; M'Quarie Harbour, 1846, *Dr. Milligan*, a fragment.

The specimens of this species are as yet too scanty to give an idea of what may be its usual state, but they are enough to show its complete departure, in the presence of the saccate lobules, from

all previously known. To the unassisted eye they scarce offer more than small stems of *M. furcata*, with which they agree in substance and colour; and it is only when their apparently sinuose outline is detected that any difference is obvious. When, however, the fronds are examined with sufficient power on the under or ventral side, it is seen that they have really marginal inflated lobules not very different from those usual in the genus *Frullania*. This appearance is in part produced by the incurvation of the inflated sac, so that its opening, which is towards the costa,

Fig. 1.



M. saccata.—A, natural size. B, much enlarged, showing the under or ventral side. C, a sac bent back in plane with the frond. D, transverse section of frond, to show the many-celled costa.

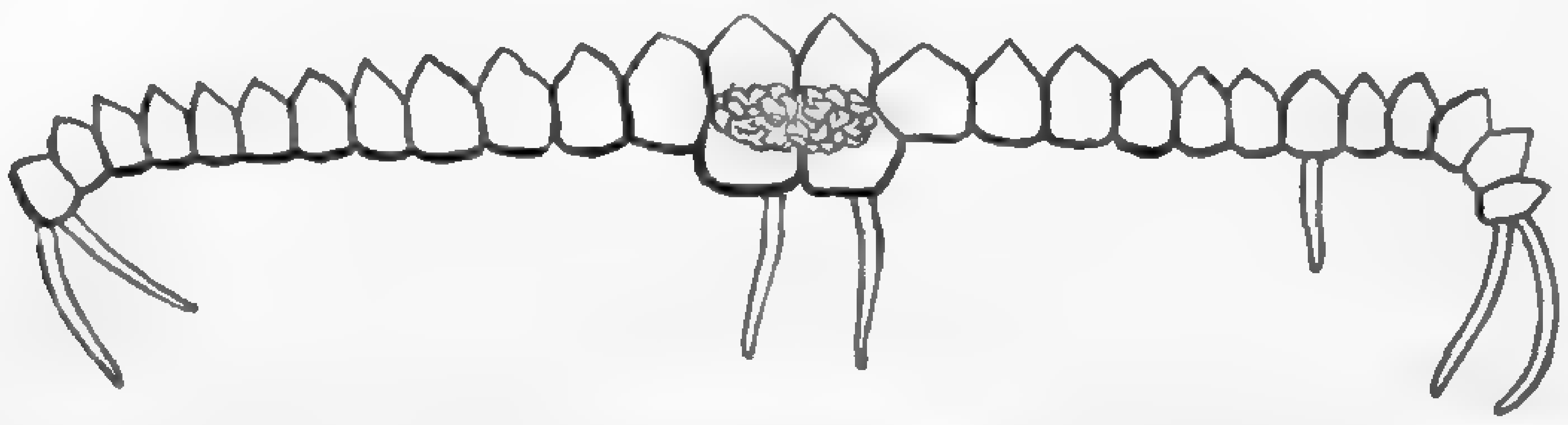
appears much less than it really is when the sac or lobule is bent back in plane with the frond. All these appendages were empty. The substance and areolation of the fronds offer nothing different from that usual in *M. furcata*; the costa is, however, of a different structure, the cells being more numerous. As to the cilia, it is believed several were seen on the first fragment examined, but none have since been met with. Young male inflorescence, of the form usual in the genus, is on the New-Zealand specimen.

METZGERIA SCOBINA, sp. n.; frons dichotome divisus, supra convexulus, dorso cellulis omnibus elevationibus conicis asper; marginibus ciliis binatis ad latus ventrale anguste incurvis, costa cellulis majoribus $\frac{2}{2}$ dispositis.

Hab. Borneo: Sarawak, on Matang Mountain, *Mr. Everett.*

Fragments only of this have been found on mosses from trees. To the unassisted eye it is altogether like *M. hamata*, but on inspection with the microscope, even in the dry state, the prominent cells showing on the incurved margins at once prove to be quite different, and on section all the cells are seen to be protuberant.

Fig. 2.



M. scobina.—Transverse section (enlarged), to show the pointed cells.

METZGERIA NITIDA, sp. n.; frons dichotomus, costa e cellulis $\frac{2}{2}$ dispositis; margine ciliis singulis binatisve paucis, cellulis magnis pellucidis lævibus iis *M. furcatæ* quadruplo majoribus.

Hab. Australia, Apollo Bay, *Sir F. von Mueller*; New Zealand, *Rev. W. Colenso*, on a specimen of *Homalia pulchella*, a 279.

This appears almost exactly similar to *M. furcata*, but its fronds are composed of cells so much longer and translucent that they have a shining look.

A Monograph of the Genus *Liparis*.

By H. N. Ridley, M.A., F.L.S.

[Read 3rd June, 1886.]

Although the literature treating of Orchids is very extensive, and is still very largely on the increase, the number of Monographs of genera is remarkably small, and, indeed, it seems that there is no Order of equal size and importance now so meagrely provided for in this respect. Species innumerable have been described as they were discovered or introduced into cultivation, often several species of different genera together, and that without correlation or comparison with other species. The result of this is that the species of many genera are inextricably confused, and it is by no means easy, even with a great deal of labour, to collate all the described species of any large genus. It not unfrequently happens also that plants are introduced, perhaps almost accidentally, into cultivation, and shortly after dying out are entirely lost, no specimens having been preserved, and only a description, often, especially among the older writers, of an insufficient character, by which the species can be identified. I have therefore thought it may be useful to those interested in this group of plants to collect what information I could glean concerning the genus *Liparis* into a single paper. No list has been published of the genus since the publication of the 'Genera and Species of the Orchidaceous Plants,' by Lindley in 1840, in which thirty-three species are described, while the number of species at present known is above 100. The collections to which I have had access are those of the British Museum, of Kew, including the Lindley herbarium, and the Wallichian herbarium of the Linnean Society; and I have here to thank Messrs. Franchet, H. Bolus, F. Moore, and Baron von Mueller, for placing in my hands specimens of rare and critical species, and Mr. A. Fryer, of Chatteris, for notes and living specimens of our native species.

The genus was originally founded by L. C. Richard (Mém. Mus. Par. iv. p. 52) for the species *Loeselii* and *liliifolia*, formerly included under *Malaxis*. Later Reichenbach ('Conspectus,' p. 69) changed the name to *Sturmia*, on the ground that the name *Liparis* was already in use for a genus of Moths. This objection is no longer considered valid, and the older name is commonly retained. *Liparis*, as it stands by itself, is a perfectly natural genus, most nearly related to *Microstylis*, but distinguished,

usually easily, therefrom by its longer and more slender column not embraced by the lip. To it the authors of the 'Genera Plantarum' have added *Ephippianthus*. This seems, however, to be distinct both in the habit and form of the lip. It is a monotypic genus found in the island of Sachalin, and is referred to the neighbourhood of *Malaxis* by Prof. Reichenbach. *Gastroglottis*, Blume, Bijdr. p. 397, is an unknown plant which, as the authors of the 'Genera Plantarum' suggest, may be a species of this genus. *Platystylis* was made by Blume as a section of *Malaxis*, and included two species, *P. decurrens* and *P. atropurpurea*. Lindley raised the section to the rank of a genus, but Bentham and Hooker (Gen. Plant. vol. iii. p. 496) refer it to *Liparis* on the strength of a plant collected by Lobb in Java, which has been identified by Prof. Reichenbach as *P. atropurpurea*. I have not seen the type of this species; but the description, so far as it goes, tallies very fairly with Lobb's plant, which is certainly a *Liparis*, and a very different plant from the *P. decurrens*, and of which there is a specimen in the herbarium of the Natural-History Museum labelled by Blume *Apatales purpurascens*, a name I cannot find published anywhere. *P. decurrens* is a very peculiar plant, differing from all other species of the genus in possessing a short thick column with four wings, two on each side. A specimen in the above-mentioned herbarium, exactly similar to Blume's figure (Bijdr. t. 54) is labelled by Blume himself *Platystylis alata*, a name which is, as far as I can find out, unpublished. This plant, standing alone, would certainly constitute a distinct genus, but *L. aurita*, Ridl., and *L. resupinata*, mihi, form connecting links between the two genera. The former of these two species possesses the rudiments of the second pair of column-wings in the form of two small ears, one on either side of the column, in addition to the ordinary wings. The flowers, too, in both are resupinate, one of the chief characters in the genus *Platystylis*. I therefore think it will be preferable to regard the genus as a section only of *Liparis*.

The species of this genus are usually small plants with inconspicuous flowers, occurring terrestrially in damp spots in bogs or woods, or among rocks, or epiphytically upon trees. The truly epiphytic species belong to the section CORIIFOLIÆ, with distinct stout pseudobulbs and thick or leathery leaves. These are confined to the tropics of the Old World. Many of the soft-leaved species, especially those with creeping stems, grow upon moss or rotten

tree-trunks in the damp forests. It is commonly stated that our native species, *L. Loeselii*, Rich., is epiphytic upon *Sphagnum*; but Mr. A. Fryer, who has had opportunities of observing the plant in the fens of Cambridgeshire, and who has kindly supplied me with living plants, informs me that he has found it sometimes, though rarely, growing directly upon clay. He suggests, in this case, that the moss may have decayed away, and that the plant manages to do without it. This may be the case, but it is not very difficult to grow the plant in ordinary soil or leaf-mould, provided it be rich enough for it; and it cannot be said to be more epiphytic upon the moss than *Droseras* or *Pinguiculas*, which are so often seen in similar situations.

Distribution.—The Liparides are one of the most widely-spread genera of the Order, only being eclipsed by the much larger ubiquitous genus *Habenaria.* Probably it owes much of this extensive distribution to its being equally adapted for temperate and tropical regions. It occurs in all portions of the globe, with the exception of the extreme north and south, and of Arabia, Persia, and New Zealand. *L. Loeselii*, Rich., is at the same time the most northern species and the most widely distributed, occurring in North America as far north as Canada, and in Europe to Sweden; while the most southern species is probably *L. reflexa*, R. Br., from Australia. *L. angustifolia*, Lindl., is perhaps the most widely distributed of the tropical species, being found in Madagascar, Ceylon, and Malaya. As a rule, however, as is the case with most Orchids, the species are very local. The largest number of species occurs in tropical Asia, which includes nearly all the section Coriifoliæ, besides a considerable number of Mollifoliæ.

The Stem.—In most species of the genus the rhizome is very short, the pseudobulbs being thrown up close together*. In many of the epiphytic species the old pseudobulbs remain for some time after they have become effete, as in *L. luteola*, Lindl., where they are closely set on the rhizome, the terminal one only being floriferous and foliiferous. In *L. Loeselii*, and species of similar habit, as a rule but two pseudobulbs are met with together, one of the present, the other of the previous year. In many species it is even unusual to find the pseudobulb of the previous year remaining, and the rhizome also has almost entirely disappeared. In *L. nepalensis*, Lindl., the rhizome is extensively

* See Pfitzer, Grundzüge vergl. Morphol. Orch. pp. 149–152; Crépin, Notes sur plantes rares Belgiques, fasc. v. p. 103.

developed, stout, woody, and persistent, the pseudobulbs being often as much as 2 inches apart. In *L. repens* the rhizome creeps for a considerable distance; it is not woody, but slender and herbaceous, throwing up numerous small pseudobulbs, each of which bears a single leaf, from the axils of some of which flower-spikes spring. From this form of rhizome we pass easily into the creeping section of the genus (*Ramosæ*). These are South-American plants, growing on damp moss or on wet trunks of trees. The stem is covered with small petiolate leaves, without any trace of a pseudobulb; towards the extremity of the creeping stem one or more scapes are thrown up singly from the axils of the leaves. The most striking species of this section is *L. brachystalix*, Reichb. f.

L. Welwitschii, Reichb. f., is another quite aberrant species, its habit closely resembling that of *Goodyera*, having a creeping stem sending up tufts of leaves, which are sometimes barren, and sometimes bear erect scapes.

The pseudobulb is naturally best developed in the epiphytic species, and is sometimes of considerable size. It is, however, somewhat variable even in the same species; thus in typical *L. spathulata* it is conical, about 2 inches in length; but I have seen plants, differing in no other respect from the typical plant, with short, almost oval pseudobulbs, and again in the true *L. longipes*, Lindl., of which *L. spathulata* is but a variety, the pseudobulb is drawn out sometimes to a length of nearly 6 inches. It is to be remembered also that, after flowering, the pseudobulb not unfrequently lengthens and alters its form somewhat. In many terrestrial species besides those mentioned above, there is no true pseudobulb, the stem being elongate and narrow, covered with leaf-sheaths, often loose, white, and membranous (*L. puncticulata*, Ridl., *L. atropurpurea*, Lindl., etc.).

Leaves.—The leaves vary to some extent, and afford good characters for breaking up the genus. In the greater number of the truly epiphytic species they are hard and thick in texture, and lanceolate or lanceolate spathulate in outline. They have no distinct petiole, and break off abruptly when dead. These are the characteristics of the section Coriifoliæ, which is quite confined to the tropics of the Old World, excluding Africa. The remaining species have thin leaves, with an outline varying from lanceolate to ovate, or rarely orbicular, often petiolate, and spreading. Many have crisped or waved margins to the leaves, and not unfrequently

they are coloured or tinted with purple (*L. Saundersiana*, &c.). As a rule, there are two or three leaves to each pseudobulb, more rarely one or more than three.

The Scape rises from the apex of the pseudobulb. It is usually in the CORIIFOLIÆ angled and winged, sometimes flattened. The base is, as a rule, nude except for a few scattered empty bracts, the lowest of which is not unfrequently, especially in the CORIIFOLIÆ, foliaceous. The inflorescence is a lax raceme, often few-flowered; but in the *L.-longipes* group the flowers are numerous and densely crowded. The most striking form is that of the section DISTICHÆ, where the raceme is shortened and flexuous, and the bracts are arranged in a distichous manner, like those of a *Dendrocolla*.

The bracts are lanceolate and green, more rarely ovate-lanceolate, usually shorter than the pedicellate ovary, and sometimes, but seldom, reflexed after flowering.

The Flower.—In the majority of species the flowers are rather small and few in number. The largest are those of *L. grandiflora*, Ridl., the smallest those of *L. longipes*, Lindl., and its allies, in which they are not only minute but very numerous. The texture is usually thin, especially in the DISTICHÆ; but in *L. elata* and many allied species the flowers, and more particularly the lip, are somewhat fleshy. The colour is most commonly yellowish green, but it varies from whitish to yellow (*L. flavescens*, &c.) and purple (*L. Saundersiana*). The sepals are usually narrow and lanceolate, the two lateral ones being frequently falcate and placed under the lip. In this case they are usually broader than the upper one, and are sometimes connate to a greater or less degree. This is not infrequent as an accident, and occurs normally in *L. disepala*, Reichb. f. When the upper sepal is dissimilar to the others, it usually resembles the petals, which are invariably linear and narrow. The petals and sepals are constantly spreading or reflexed; but in *L. viridiflora*, Lindl., the flower seems never to open entirely. The lip is most commonly entire, more rarely distinctly 2- or 3-lobed. The base is usually narrowed, with the edges raised and often thickened, so as to form a channel down the centre. The claw stands parallel to the face of the column, the lamina being bent abruptly downwards. In this case there are usually two (rarely a single) conical calli at the base of the claw, formed by the thickening of the lateral veins of the lip; and all stages of the development of these protuberances are to

be met with, from the simple thickening and sometimes colouring of the veins, as in *L. elliptica*, *L. neuroglossa*, &c., to the complete distinct calli (*L. elata*, &c.). In *L. aurita*, Ridl., and its allies the veins at the base of the lamina are pushed a little to the side and thickened, so as to form a horseshoe-shaped callus with a slight depression in the centre. In many species the lip has no erect claw, but the whole of the lip lies parallel, or almost so, to the column; and in *L. elliptica*, Reichb. f., the sides of the lip are so curved up as to enclose and conceal the column.

The *column* is usually long and slender and more or less curved, with the base and apex dilated. The sides of the stigma are flanked by two small membranous wings more or less triangular in outline. They are rarely absent (*L. Welwitschii*, Reichb. f.), and in *L. decurrens* (*Platystylis*, Blume) there are an extra pair outside the normal pair, rudiments of which may be seen in *L. aurita*, Ridl., a closely allied plant, in the form of a pair of minute lobes. The species of this section are also remarkable for their short, thick, straight column. The column of *L. disticha*, Lindl., is similar in shape, though the plant is very different in other respects; but the two other species of the same group (*Distichæ*), *L. Cumingi*, Ridl., and *L. compressa*, Lindl., have the slender arcuate column of the rest of the genus.

The anther-cap is usually ovate and acute, sometimes, as in *L. ornithorrhynchos*, Ridl., distinctly beaked. It is more or less distinctly bilocular, and contains two pairs of ovoid pollinia usually adhering together in pairs by their apices. The stigma is usually rather small, elliptical or oval, rarely (*L. Welwitschii*) deeply sunk.

The capsule is usually pyriform globose in the small epiphytic species of the genus, such as *L. cæspitosa*, Lindl., and *L. longipes*, Lindl. In the terrestrial species it is commonly elongate conical (*L. Loeselii* and *L. elata*). When ripe it has usually distinct ribs, which are rarely sinuous (*L. Forbesii*, Ridl.). As the fruit ripens the pedicels elongate a little, and in some of the epiphytic species not unfrequently become recurved. This is especially noticeable in *L. flaccida*, Reichb. f. In *L. Loeselii*, Rich., and species of similar habit, the fruit remains stiffly erect, and as it were adpressed to the rhachis. It is possible that this may bear some relation to the seed-distribution, for whereas in the epiphytic species it would be advantageous to the plant to spread its capsules, that the wind might catch them more readily and drift

the seeds upon other and lower branches of the trees on which the plants grow, in the case of the marsh-loving species, were the seed-pods to be recurved, there would be considerable risk of the seeds falling too close to the parent plant.

Fertilization.—I cannot find that, with one exception, any observations have been published upon the fertilization of any species of the genus. Mrs. Barber (Journ. Linn. Soc., Bot. x. 1869, p. 455) suggests that small Hymenoptera or Diptera might be the impregnators of *L. Bowkeri*, Harv., which species she cultivated in her garden in South Africa, but found them not fertilized there. She remarks that she never found any honey in the blossoms; neither have I been able to detect any in any of the species which I have been able to examine in a living state. The flowers do not appear as a rule to have any scent; but *L. longipes* is an exception, it has an unpleasant odour. Notwithstanding this, they seem to be in some way attractive to insects, as I have seen ants busily running about upon the lip of *L. Saundersiana*, Reichb. f., as if there was something there worth seeking.

The insect attractions to the plant are of three kinds. In plants of the *L. longipes* type there is a smooth polished band of a darker green than the rest of the lip running for the whole length of the labellum, very similar to that which occurs in the lip of *Listera ovata*, R. Br. The lip in these species is so curved that its highest part is immediately under the anther, so that an insect alighting upon the apex of the lip and creeping up would strike with its head the anther and receive the pollinia. In some of the larger-flowered plants, in which this would appear to be the means of fertilization, there is an ochreous or orange patch in the centre of the lip (*L. reflexa*, R. Br., *L. laciniata*, Ridl.). In another series of plants the veins at the base of the lip are thickened, and sometimes (*L. neuroglossa*, Reichb. f.) brightly coloured. These doubtless are attractive to insects; and once in a flower of *L. elliptica*, Reichb. f., from Venezuela, I found the base of the lip had been gnawed by some animal, and there were a pair of pollinia lying in the stigma. This, however, may have been accidentally done in pressing the flower.

A considerable number of species, again, have these veins raised at the extreme base of the lip into two conical calli. In this case the lip usually, as stated above, has a distinct channelled claw and a broad deflexed lamina; sometimes there is only one callus, which is in some cases notched at the apex, from which it appears

probable that it was formed by the amalgamation of the two calli. *L. disticha,* Lindl., is peculiar in having a patch of irregular warty calli at the base of the lip.

In many of the calliferous species the insect is directed to the callus by the recurved edges of the claw; but in *L. Rheedii,* Lindl., there are two guiding ridges, apparently formed by the pinching-up of the lamina which run from the base of the lip, flanking the calli, till they are gradually merged in the lamina.

In the two last series the point of attraction lies at the base of the lip close to the column, while the pollinia are situate in the first case over the middle of the flat lamina, and in the second over the highest point of the lip, that is, where the lamina joins the unguis and forms an angle with it; so that if the insect receives the pollinia as it leaves the flower, as is usually the case, they would in all probability be attached to its back. In the first series, however (the *L. longipes* section), and in the case of *L. aurita,* Ridl., the point of attraction is not at the base of the lip but at its highest point, *i. e.* in the former at the top of the curve formed by the lip, and in the latter at the junction of lamina and unguis. The latter has been alluded to under the general description of the lip; but I will proceed to give further details. The veins which arise from the base of the lip run straight up the claw till they reach the lamina, where they become sigmoid, each forming a semicircle in their course, the ends of the semicircles being so closely approximated as almost to meet, especially at the upper end. This forms a horseshoe-shaped ridge with a distinct depression in the centre at the highest point of the lamina. The anther overhangs this ridge, so that in this plant, as well as in the *L. longipes* section, the head of the fertilizer is naturally exactly under it, and in all probability the pollinia would be attached to its head.

Divisions.—The genus is best divided up into Coriifoliæ, the hard-leaved epiphytic section, and Mollifoliæ with soft leaves. The names, which originated with Professor Reichenbach, are preferable to Lindley's *Liparis vera* and *Cestichis,* the latter a name invented by Thouars for some of the hard-leaved Mascarene species.

The Mollifoliæ have frequently no pseudobulbs, but a straight, longer or shorter stem covered with sheathing-leaves, often whitish and membranous. The leaves are thin and plicate, often more than two in number, not rarely petiolate and oval, or

ovate-lanceolate. They do not drop off abruptly, but wither on the stem. Their distribution is that of the genus.

The Coriifoliæ, including Thouars's *Distichis*, have distinct pseudobulbs, oval to conical in shape, the leaves stiff and leathery, usually two in number, and lanceolate, breaking off abruptly when dead from the top of the pseudobulb, and leaving a scar, never withering on the pseudobulb. They are usually epiphytic, and are confined to the tropics of the Old World.

It is true that these sections pass into each other, as Bentham and Hooker (Gen. Plant. iii. p. 495) state, but they are certainly the most satisfactory and natural.

Liparis, *L. C. Richard*,

Mém. Mus. Par. iv. p. 52; ***Benth. & Hook. f. Gen. Pl.*** iii. p. 495.

Sturmia, *Reichenbach, Conspectus*, p. 69; *Iconogr. Bot.* t. 956.
Alipsa, *Hoffmannsegg, Linnæa*, xvi.
Malaxis, *auctorum veterum.*
Empusa, *Lindley, Bot. Reg.* sub 825.
Empusaria, *Reichb. Consp.* p. 69.
Platystylis, *Lindley, Orch. Pl.* p. 18.

Herbæ perennes, epiphyticæ vel terrestres, caulibus primariis plus minusve repentibus, ramis sæpe pseudobulbosis, brevibus et crassis, vel longioribus angustioribus, foliis vaginantibus sæpe albescentibus membranaceis tectis, arcte approximatis vel rarius dissitis. Folia evoluta, 1–6, membranacea, ovata petiolata vel lanceolata, aut carnosa vel coriacea, lanceolata spathulata, in apicem pseudobulbi subrosulata vel raro dissita in rhizomate. Scapi singuli ex apice pseudobulbi orientes, teretes, vel angulati et alati. Racemus sæpius laxus pauciflorus aut aliquando densus multiflorus. Bracteæ sæpissime ovariis breviores lanceolatæ, raro bifariam distichæ. Flores mediocres vel minores, haud raro minimi ochrei flavidi vel virides, rarius purpurascentes. Sepala et petala omnia libera reflexa (perpaucis exceptis) angusta linearia, vel lanceolata, petala semper linearia, sæpissime quam sepala angustiora, nunquam latiora. Labellum unguiculatum, ungue sæpius ad columnam parallelo, lamina latiora integra vel bifida, rarius subtrifida vel irregulariter laciniata, callis nullis vel duobus conicis rarius singulo ad basin. Columna apoda sæpissime gracilis arcuata, alis brevibus duabus subtriangulis ad latera foveæ, rarissime (in una specie) alis quatuor. Anthera ovata

biloculata, loculis vix omnino segregatis. Pollinia 4, cerea, ovoidea, sæpe acuminata, apicibus per paria conjunctis; stigma hemisphærica rarissime profunda. Capsula pyriformis, globosa, sæpe pendula, vel elongata conica, erecta, costis sæpissime distinctis.

§ Mollifoliæ.—Folia membranacea sæpius ovata subpetiolata. Petiolus longe vaginans, haud articulatus. Pseudobulbus raro distinctus.

Caulis hornotinus, annotino appressus; rhizoma brevissimum.

Elatæ.—Folia plura erecta lanceolata vel oblonga angusta acuta; flores parvi carnosuli; lamina labelli deflexa; callis duobus (rarius unico) ad basin unguis.

Sepala lateralia libera lanceolata, petalis latiora.

Species Americanæ et Africanæ.

Labellum haud crenulatum.

Sepala lateralia falcata.... 1. *L. elata.*

Sepala lateralia recta .... 3. *L. bicornis.*

Labellum crenulatum.

Flores virides (Africana).. 4. *L. guineensis.*

Flores albi (Americana) .. 5. *L. Kappleri.*

Species Australasica............ 2. *L. habenarina.*

Species Asiaticæ.

Calli conspicui.

Caulis vaginis foliaceis tectus hinc validulus.

Labellum costis elevatis duabus in lamina...... 6. *L. Rheedii.*

Labellum ecostatum emarginatum.

Flores flavescentes vel virides .... 7. *L. paradoxa.*

Flores purpurei .... 8. *L. nervosa.*

Caulis tenuis vaginis membranaceis, pseudobulbus parvus globosus.

Folia patula.

Folia plura, bracteæ post anthesin haud deflexa.

Labellum obtusum ...... 9. *L. bituberculata.*

Labellum apiculatum .... 10. *L. odontostoma.*

Folia bina evoluta, bracteæ post anthesin deflexa.
Folia ½ unciam lata .... 11. *L. olivacea.*
Folia 3 uncias lata .... 12. *L. platyphylla.*
Calli inconspicui vel subnulli, folia longissima acuta acuminata.
Flores iis *L. elatæ* æquales, dissiti .... 13. *L. ferruginea.*
Flores minimi, apice scapi aggregati .... 14. *L. acutissima.*
Sepala lateralia libera linearia, petalis subsimilia .... 39. *L. longa.*
Sepala lateralia connata.
Lamina labelli linguiformis integra .... 15. *L. abyssinica.*
Lamina labelli cuneata retusa. 16. *L. disepala.*
Ellipticæ.—Folium evolutum singulum.
Folium ellipticum lanceolatum erectum.
Labellum ovatum obtusum ...... 17. *L. elliptica.*
Labellum oblongum apiculatum .. 26. *L. glossula.*
Labellum subtrilobum bicallosum. 18. *L. campestris.*
Folium ovatum cucullatum repandum.
Labellum latum apiculatum.
Planta 8-uncialis .... 19. *L. clypeolum.*
Planta 4-uncialis .... 20. *L. cuspidata.*
Labellum oblongum obtusum .... 25. *L. rupestris.*
Folia bina ovata distincte petiolata, subdissita.
Labellum dentatum obovatum .. 21. *L. auriculata.*
Labellum integerrimum vel rarius obscure crenulatum.
Labellum flavidum .... 22. *L. hawaiensis.*
Labellum purpureum .... 23. *L. viridipurpurea.*
Folia bina non vel brevissime petiolata congesta.
Flores mediocres; labellum ecallosum.
Sepala lateralia angusta recta.
Bracteæ pedicellis æquales .... 24. *L. arnoglossophylla.*

Bracteæ pedicellis multo minores.
Folia ultra dimidium longitudinis lata .... 25. *L. rupestris.*
Folia vix dimidio longitudinis lata.
Labellum basi purpureo-maculatum .... 27. *L. Beddomei.*
Labellum concolor, oblongum acutum .... 28. *L. liliifolia.*
Sepala lateralia falcata .... 31. *L. ornithorrhynchos.*
Flores mediocres virescentes; labellum callosum.
Caulis brevis uncialis; vaginis foliaceis.
Petala sepalis subæquilonga.
Labellum obtusum .... 30. *L. Bowkeri.*
Labellum longe cuspidatum . 29. *L. Krameri.*
Petala sepalis longiora .... 51. *L. longipetala.*
Folia ultra duo, ovata vel ovato-lanceolata.
Rhizoma brevissimum.
Sepala cum petalis connata ...... 33. *L. connata.*
Sepala et petala libera.
Flores majores; caulis breviusculus .. 32. *L. ochracea.*
Caulis elatus; vaginis albescentibus tectus.
Labellum integrum .... 34. *L. longicaulis.*
Labellum emarginatum: margines crenulatæ ecallosum .. 35. *L. puncticulata.*
margines crenulatæ bicallosum .. 38. *L. polycardia.*
margines integræ .... 39. *L. longa.*
Flores parvæ virescentes vel flavescentes.
Sepala angusta, petalis similia.
Racemus densus, multiflorus .... 40. *L. capensis.*
Racemus laxus.
Folia oblongo-lanceolata acuta.
Labellum obovatum oblongum . 41. *L. Loeselii.*
Labellum pentangulum retusum. 43. *L. campylostalix.*
Folia lanceolata, basi longe acuminata flaccida .... 50. *L. Gerrardi.*
Folia cuneata lanceolata.
Labellum serrulatum .... 52. *L. tricallosa.*

Folia ovata vel subcordata.
Labellum integrum.
Flores omnino virides ...... 42. *L. japonica.*
Labellum emarginatum serrulatum .... 45. *L. Wendlandii.*
Sepala lateralia, petalis latiora falcata.
Planta pusilla, 3-uncialis .... 46. *L. Guingangæ.*
Planta ultra, 3-uncialis.
Labellum integrum.
Pedicelli strictim erecta .... 47. *L. lutea.*
Pedicelli patentes.
Sepala lateralia ovata; flores flavi .... 48. *L. xanthina.*
Sepala lateralia lanceolata; flores olivacei .... 49. *L. parva.*
Labellum bilobum ligulatum .. 37. *L. Eggersii.*
Flores parvi purpurascentes.
Labellum glabrum ecallosum .... 44. *L. Saundersiana.*
Labellum glabrum callosum .... 53. *L. brachyglottis.*
Labellum hispidum .... 54. *L. barbata.*
Pusillæ vix triunciales.
Labellum bilobum .... 55. *L. biloba.*
Labellum integrum cordatum acutum.................... 56. *L. Jovis-Pluvii.*
Caulescentes.
Labellum oblongum .... 57. *L. Walkeriæ.*
Labellum obovatum serratum .. 58. *L. montana.*
Flores majores.
Labelli margines anticæ inflexæ pectinatæ................ 59. *L. pectinata.*
Labellum haud pectinatum oblongum ovatum .... 60. *L. atropurpurea.*
Labellum integrum orbiculare.. 61. *L. Wightiana.*
Rhizoma diu persistens longa; caules secundarii dissiti.
Pseudobulbi distincti.
Folia plura; flores virescentes . 62. *L. nepalensis.*
Folia singula; flores purpurei . 63. *L. repens.*
Pseudobulbi nulli.
Labellum dentatum .... 65. *L. purpurascens.*
Labellum ligulatum bilobum . 64. *L. stenoglossa.*

Labellum integrum.
Flores minimi aggregati .. 67. *L. Welwitschii.*
Flores parvi dissiti ...... 66. *L. neuroglossa.*
Flores majores; labellum $\frac{1}{8}$ unciam longum ...... 36. *L. flavescens.*

Ramosæ.—Caulis primarius longe repens foliis ovatis petiolatis solitariis omnino tectus; racemi in axillis superioribus.
Flores magni; labellum $\frac{5}{8}$ unciam longum atropurpureum ...... 68. *L. crispifolia.*
Flores mediocres.
Labellum album obtusum .... 70. *L. ramosa.*
Labellum album cuneatum flabellatum .... 71. *L. Wageneri.*
Labellum viride cuspidata...... 69. *L. brachystalix.*

§ Coriifoliæ.—Folia coriacea vel subcoriacea rigida cum pseudobulbo articulata.
Racemus laxus, flores haud copiosi, raro resupinati. Columna gracilis bialata.
Plantæ majores circiter pedales.
Labellum obovatum bilobum.
Labellum $\frac{3}{4}$ unciam longum...... 72. *L. grandiflora.*
Labellum vix $\frac{1}{2}$ unciam longum.
Scapus teres.
Bracteæ pedicellis multo breviores. 73. *L. crenulata.*
Bracteæ pedicellis æquales seu longiores .... 74. *L. latifolia.*
Scapus anceps.
Folium singulum .... 75. *L. Forbesii.*
Folia bina .... 76. *L. chloroxantha.*
Labellum margine lacerato .... 77. *L. lacerata.*
Labellum oblongum ellipticum denticulatum.......................... 78. *L. Beccarii.*
Labellum subquadratum crenulatum. 79. *L. diodon.*
Labellum integrum.
Folia singula rarius bina multinervia.
Racemus laxus.
Columna crassiuscula ...... 80. *L. plicata.*

Columna gracilis cycnicollis.
Labellum integrum ...... 81. *L. bootanensis.*
Labellum crenulatum . . . 84. *L. cœlogynoides.*
Racemus densiusculus .... 82. *L. Griffithii.*
Folia bina patula majora.
Labellum planum ellipticum rotundatum............ 85. *L. plantaginea.*
Folia plura erecta.
Labellum unguiculatum, macula ochrea .... 86. *L. reflexa.*
Labellum trifidum .... 83. *L. Mannii.*
Plantæ minores, humiles, flores parvi.
Flores aperti.
Pseudobulbus ½ unciam crassus tumidus.
Labellum subbilobum crenulatum .... 87. *L. pachypus.*
Labellum divergenti-bilobum, denticulatum .... 88. *L. grossa.*
Labellum integrum .... 90. *L. Hookeri.*
Pseudobulbus angustior.
Labellum lineari-panduratum. 89. *L. bistriata.*
Labellum obovatum.
Bracteæ floribus breviores.
Labellum bicallosum ...... 92. *L. luteola.*
Labellum ecallosum .... 93. *L. revoluta.*
Bracteæ flores superantes .... 94. *L. cæspitosa.*
Flores inaperti .... 91. *L. viridiflora.*

Platystylis.—Columna crassa brevis lata; flores parvi resupinati.
Alæ columnares evolutæ duæ.
Flores virides; labellum integrum 95. *L. resupinata.*
Flores aurantiaci; labellum apice trilobum............ 96. *L. aurita.*
Alæ columnares evolutæ 4 ...... 97. *L. decurrens.*

Distichæ.—Racemus brevis congestus, bracteæ bifariæ.
Folium 1½ unciam latum .... 98. *L. compressa.*
Folium ½ unciam latum.
Columna arcuata gracilis...... 99. *L. Cumingii.*
Columna brevis crassa recta ..100. *L. disticha.*

Densifloræ.—Flores minimi copiosi densi.

Labellum integrum.	
Folia lanceolata spathulata.	
Labellum e basi columnæ oriens..	101. *L. longipes.*
Labelli anguli pone columnam brevissime producti..........	102. *L. pusilla.*
Folia lineari-lanceolata angusta.	103. *L. clavigera.*
Labellum retusum crenulatum ..	104. *L. vestita.*
Labellum trilobum.	
Lobus medius triangulus integer.	105. *L. stachyurus.*
Lobi omnes denticulati	106. *L. Stricklandiniana.*
Lobus medius ovatus lanceolatus......................	107. *L. triloba.*
Lobus medius obtuse tridentatus	108. *L. dendrochilum.*
Lobus medius bilobus	109. *L. parviflora.*
Labellum apice bilobum	110. *L. flaccida.*

§ Mollifoliæ.

Herbæ tenues, sæpe terrestres, foliis herbaceis viridibus purpurascentibus ovatis vel lanceolatis, in apicibus caulium secundariorum sæpe vix basi incrassatorum marcescentibus nec articulatis.

1. L. elata, *Lindl. Bot. Reg.* t. 1175; *Orch. Pl.* p. 27.

Caulis basi pseudobulbosus, vaginis viridibus tectus, uncialis; folia lanceolata acuminata erecta 4–6 uncias longa, unciam lata; scapus pedalis vel altior, angulatus et alatus, basi nudus; racemus laxus multiflorus; flores parvi, fusco-viridis vel purpurascentes; bracteæ lanceolatæ 2 lineas longæ; sepalum posticum angustum lanceolatum obtusum, lateralia latiora subfalcata; petala multo angustiora linearia obtusa; labellum carnosulum unguiculatum obovatum emarginatum, sæpius macula pustulata obscuriore ad basin; calli duo conici in basin; columna suberecta apice curva subclavata, alis brevibus latis obtusis; pedicelli erecti cum ovariis ½ unciam longis.

West Indies: Jamaica, *Morris*!; St. Vincent, *Anderson*!; Dominica, *Imray*! Costa Rica, *Wendland.* Ecuador, Banos near the river Verde, *Spruce* no. 5382! Venezuela, *Fendler* no. 2141! Caripe, *Moritz* no. 618! Merida, *Linden*! no. 677! Brazil, *Burchell* 2277! Organ Mountains, *Gardner*, 675, 676! *Miers* no. 2447! Minas Geraes, *Widgren*!

Var. INUNDATA, *Rodriguez, Gen. & Sp. Orch.* p. 86.

Minor, hydrophila, foliis plicatis cum marginibus incurvis, floribus flavis, labello oblongo subquadrato, apice retuso.—Brazil.

Var. LATIFOLIA. Caulis magis dilatatus ad basin; folia plura, late ovata, 6–9 uncias longa, 2–3½ uncias lata, obtusa vel acuta; scapus elatus angulatus et breviter alatus; flores fusco-virides vel flavi, labello fusco; sepalum posticum lanceolatum ligulatum obtusum, lateralia lanceolata latiora subacuta haud falcata.

Cuba, *Wright* no. 1495! Paraguay, Valenzuela, *Balansa* no. 4542!

Var. RUFINA. Flores rufi, obscuri; labellum vix emarginatum.

Africa: Lagos, *Barter*! ("flowers deep red"); Sierra Leone, *Morson*!

2. L. HABENARINA, *F. Muell. Fragm. Fl. Austral.* iv. p. 131; *Benth. Flor. Austral.* vi. p. 273.—Sturmia habenarina, *F. Muell. l. c.*

Pseudobulbus oblongus, foliis vaginantibus tectus more *L. paradoxæ*, biuncialis; folia evoluta bina, lanceolata erecta acuta, 5 uncias longa, ½ unciam lata; scapus crassiusculus vix angulatus 9-uncialis; flores parvuli laxi; bracteæ lanceolatæ angustæ; sepala lateralia falcata obtusa carnosula, posticum petalaque linearia obtusa membranacea; labellum carnosulum breve, sepalis lateralibus vix æquans, lamina oblongo-cuneata obtusa deflexa; apice paullo retuso cum cuspide mediana minuta; calli parvi conici ad basin unguis; columna crassiuscula erecta paullo curva, apice dilatata, alis parvis subacutis; anthera ovata acuta, loculis distinctis.

Australia: Queensland, Rockingham Bay, *Dallachy*!

3. L. BICORNIS, *Ridl. Journ. Linn. Soc., Bot.* vol. xxi. p. 458.

Differt racemo densiusculo, labello oblongo-cuneato emarginato, sepalis ovato-lanceolatis haud falcatis, sepalo postico lanceolato.

Madagascar, *Hildebrandt*! *Baron*!

4. L. GUINEENSIS, *Lindl. Bot. Reg.* t. 1671.

Pseudobulbus "ovatus parvus, avellanæ nucis magnitudine"; folia lanceolata acuminata plicata, 5½–6½-uncialia vix unciam lata; scapus angulatus, 11-uncialis; racemus longus laxiusculus; flores virides 20–30; bracteæ lanceolatæ acuminatæ, ¼-unciales, quam ovarium breviores; sepalum posticum angustum lineare oblongum obtusum, lateralia ovata oblonga falcatula obtusa, labello æquilonga; petala linearia quam sepalum posticum angustiora quam sepala longiora; labellum cuneato-obovatum bilobum, margine

crenulato, calli cornuti breves; columna crassiuscula, apice curva, alis rotundatis brevibus latis; anthera ovata obtusa.

Western Tropical Africa, Sierra Leone, *Wilford*! *Whitfield*

5. L. Kappleri, *Reichb. fil. in Walp. Ann.* vi. p. 218.—Sturmia Kappleri, *Reichb. fil. in Bonplandia*, ii. p. 22.

Folia oblonga acuta, basi cuneata membranacea; scapus elongatus in sicco sulcatus apice pauciflorus; bracteæ lineares, sub anthesin reflexæ; sepala oblonga obtusa subæqualia; petala linearia obtusa; labellum cuneatum antice retusum obscure bis emarginatum crenulatum; columna incurva alata; flores albi. Differt *L. guineensi*, Lindl., caule alato et forma labelli.

Surinam, Para, *Kappler* (non vidi; forsan varietas *L. elatæ*).

6. L. Rheedii, *Lindl. Orch. Pl.* p. 27; *Miq. Fl. Ind. Bat.* iii. p. 621.—Malaxis Rheedii, *Blume, Bijdr.* p. 389, t. 54.

Caulis subcylindricus vix pseudobulbosus, foliis vaginantibus pluribus tectus; folia evoluta tria erecta lanceolata acuminata acuta, subpetiolata, 3–6 uncias longa, $1\frac{1}{2}$ lata; scapus elatus crassiusculus angulatus 9-uncialis usque pedalis; racemus multiflorus; flores carnosuli virescenti-flavi; bracteæ lanceolatæ acuminatæ foliaceæ, ferme $\frac{1}{2}$ unciam longæ, ovariis æquantes vel inferiores paullo superantes; sepalum posticum anguste ligulatum obtusum, 4 lineas longum; lateralia late oblonga elliptica falcatula; petala anguste linearia ligulata; labellum obovatum rotundatum obtusissimum marginibus minute crispulis, costis duabus in lamina ad callos conicos euntibus; columna crassiuscula basi et apice dilatata apice arcuata, alis brevibus vix conspicuis; anthera depresso-conica.

Java: Mt. Seribu, *Blume*; Tjikoya, *Zollinger* 146, *Horsfield*!

7. L. paradoxa, *Reichb. fil. in Walp. Annals*, vi. p. 218.—Empusa paradoxa, *Lindl. Bot. Reg.* t. 825, *Orch. Pl.* p. 17; *Miq. Prolus. Fl. Jap.* p. 135.—Empusaria ——, *Reichb. f. Conspectus*, p. 69.—Malaxis lancifolia, *Smith in Rees's Cyclop.*

Caulis sæpius vix pseudobulbosus brevis; folia lanceolata acuminata suberecta, 5 uncias longa, $1\frac{1}{2}$ lata; scapus angulatus et ad basin alatus, 6-uncialis; racemus laxus terminalis multiflorus; bracteæ lanceolatæ acuminatæ erectæ dimidio ovarii æquales, $\frac{1}{2}$ unciam longæ; flores iis *L. elatæ* æquales viridi-flavi; sepala oblonga obtusa lateralia semiovata falcata basi obscure paullo connata; petala linearia angusta; labellum obovatum retusum

cuspide minuto, marginibus ad apicem minute denticulatis; calli conici; columna gracilis arcuata, alis brevibus ovatis.

India: Nepal, Kumaon, *Blinkworth, Wallich herb.* no. 1937 pars! Canara and Mysore, *Law.* Malabar, *Hooker & Thomson*, Liparis, ii.! Guliwal, *Falconer.* Moulmein, *Parish*! Khasiya hills, *Hooker & Thomson*!

Siam and Cambodia, Angkor Than, Iles de Phuquoc, and Bayoc, *Godefroy-Leboeuf*! Java, Modjiterti, *Zollinger*, Iter. ii. no. 8766.

L. odorata, *Lindl. Orch. Pl.* p. 26; *Reichb. fil. in Walp. Ann.* vi. p. 217.—Malaxis odorata, *Willd.* no. 6.—Katton pounam Marawara, *Rheede, Hort. Malabar*, xii. p. 55, t. 28, mihi videtur hæc species esse, nam figura satis bene congruit, forma coloreque, est etiam species vulgaris Malabarica. Thwaites (Enum. Pl. Ceyl. p. 295) credidit *L. odorata* esse *L. elata*, Lindl. (i. e. *L. bituberculata*, Lindl.), *L. odorata*, Benth., Flora Hongkong, p. 352, sine dubio *L. nervosa* est. Itaque, specie omnino dubia, nomen etsi antiquius melius delendum.

Foliola duo sunt in herbario Wallichiano sub numero 1937 et nomine *Empusæ paradoxæ*, in collectionibus societatis Linnæanæ; harum unum (1937 *a*) continet specimen singulum *L. olivaceæ* cum tribus *E. paradoxae,* alterum (1937 *b*), specimen *L. paradoxae,* ~~defloratum, cum tribus *L. bituberculatæ*~~.

8. L. NERVOSA, *Lindl, Gen. & Sp. Orch. Pl.* p. 26.—*Reichb. fil. in Walp. Ann.* vi. p. 217; *Benth. Fl. Hongkong.* vol. vi. p. 352; *So Mokou Soussetz*, xviii. p. 67, fig. C; *Franchet & Savatier, Enum. Pl. Jap.* ii. p. 21.—Ophrys nervosa, *Thunb. Fl. Japon.* p. 27.—Epidendrum nervosum, *Thunb. Ic. Pl. Jap.* dec. i. t. 10. —Sturmia nervosa, *Reichb. fil. in Bonplandia*, iii. p. 250.

Habitus *L. paradoxæ.* Caulis brevis vix pseudobulbosus; folia ovata vel lanceolata acuminata, 2–3 rarius 4 tenuia; scapus 3–6-uncialis; racemus laxus, flores iis *L. paradoxæ* æquales rubri vel purpurei; sepala lateralia oblonga lanceolata falcata, posticum angustius, ellipticum lanceolatum, petala linearia, omnia pallide purpurea vel flavo-rubra; labellum obovatum obtusum emarginatum, marginibus integris purpureum; calli parvi; columna curva, alis distinctis subacutis.

China: Hong Kong, Victoria Peak, *Champion*! *Wilford, Hance.* Japan; Nippon, *Thunberg*; Niko, *Savatier*; Nagasaki, *Maximowicz*!

Formosa, *Oldham*! Loochoo Islands, *Wright* no. 342!

Hæc planta (præsertim sicca) *L. paradoxam* simulat, sed differt semper ut videtur colore. Hanc ex India non vidi nec illam ex regione Japonica-sinica.

9. L. BITUBERCULATA, *Lindl. Bot. Reg.* p. 882.—Cymbidium? bituberculatum, *Hooker, Exot. Flor.* t. 116.—Sturmia bituberculata, *Reichb. fil. in Bonplandia*, ii. p. 22.

Caulis distinctus triuncialis, vaginis laxis albescentibus (in sicco) tectus, basi vix dilatatus, radices crassi lanati; folia plura lanceolata acuminata patula, 5 uncias longa, 1½ lata; scapus 8–12-uncialis angulatus; racemus laxus multiflorus; bracteæ lanceolatæ; pedicelli ½-unciales, graciles; flores purpurei; sepala linearia ligulata, lateralia falcatula; petala multo angustiora; labellum oblongum cuneatum paullo retuso, marginibus integris; calli conici; columna erecta, apice curva, alis brevibus triangulis subacutis.

India: Nepaul, *Wallich* no. 1937, 2 pars! Kumaon, *Blinkworth*, sub nomine *L. paradoxæ*, Lindl! Sikkim, *J. D. Hooker*!

Ceylon, *Thwaites* no. 3180, 3375.

Var.? FORMOSANA.—L. formosana, *Reichb. f. in Gard. Chron.* 1880, p. 394.

Pseudobulbi elongati ferme cylindrici, folia oblonga acuta, crispa; labellum sagittatum oblongum acutum.

Formosa, introd., *Maries*.

10. L. ODONTOSTOMA, *Reichb. fil. in Linnæa*, xli. p. 97.

Pseudobulbus subteretiusculus, apice plurifolio; folia circiter 4 cuneato-oblonga acuta membranacea; scapus exsertus pluriflorus racemosus; sepalum posticum lanceo-trinerve, lateralia oblongo-ligulata obliqua 4-nervia curva; petala linearia uninervia; labelli unguis basi utrinque obtusangulus, lamina subquadrata antice emarginata cum apiculo ungui æquilonga, calli conici gemini ante basin unguis; columna basi et apice ungulata (? angulata). Planta bipedalis; flores verosimiliter olivacei.

Sikkim, 3000–5000 feet, *Hooker*.

11. L. OLIVACEA, *Lindl. Wall. Cat.* no. 1942; *Orch. Pl.* p. 27.

Caulis uncialis angustus, basi pseudobulbo parvo ovali distincto; folia bina lanceolata acuminata, 5-nervia, 3 uncias longa, ½ lata (quo latissima); scapus 6-uncialis angulatus, basi nudus; racemus multiflorus, flores iis *L. paradoxæ* æquales, olivacei; bracteæ lanceolatæ acuminatæ, post anthesin deflexæ; sepala angusta ligulata obtusa lateralia falcatula; petala anguste linearia;

labellum cuneatum obovatum emarginatum cuspide minuto, marginibus integris; calli breves conici; columna gracilis arcuata, alis obscuris.

Nepal, *Wallich* no. 1942!

L. odorata, Lindl., valde affinis, sed bracteis $\frac{3}{8}$ unciam longis, sub anthesin deflexis, floribusque majoribus et colore diverso distinctus. In herbario typico Wallichiano est etiam specimen singulum cum *L. paradoxa* commixta sub numero 1937 *a*.

12. L. PLATYPHYLLA, n. sp.—Caulis 1–2-uncialis, angustus; folia bina ovata vel ovata lanceolata acuta, patula, 7-nervia, 4 uncias longa, 3 lata; scapus erectus debilis basi nudus pedalis; flores plures laxe racemosi; bracteæ lanceolatæ acuminatæ, primum erectæ comosæ demum reflexæ pedicellis æqualibus; sepala lanceolata ligulata, lateralia labello supposita; petala angustiora; labellum obovatum rotundatum paullo retusum marginibus crenulatis, unguis brevis; calli conici duo; columna crassiuscula brevis, alis obtusis longis angustis.

Anamallays, 3500 ped. alt., *Beddome*! *Herb. Brit. Mus.*

Præcedenti affinis sed foliis latioribus, labello crenulato diversa.

13. L. FERRUGINEA, *Lindl. in Gard. Chron.* 1848, p. 55.

Planta sesquipedalis vel bipedalis. Pseudobulbus ovalis brevis, caulis rectus elongatus; folia 3–4 angusta lanceolata acuminata stricta 6–15 uncias longa, $\frac{1}{2}$ unciam lata; scapus elongatus vix angulatus exalatus, validulus, superne racemosus; racemus laxus multiflorus, flores iis *L. bituberculatæ* æquales; bracteæ lanceolatæ minimæ demum deflexæ; sepalum posticum angustum lanceolatum, lateralia latiora labello supposita, vix falcatula; petala anguste linearia; labellum cuneatum rotundatum retusum cuspide minuto, ferrugineum vel roseum etuberculosum; columna curvula, alis obtusis.

Borneo, Labuan, *Lobb*! Malacca, *Griffith*!

Cambodia, Mont de Pursat, *Godefroy-Leboeuf*!

L. paradoxæ et *olivacea* affinis, sed ecallosa.

14. L. ACUTISSIMA, *Reichb. fil. Otia Hamb.* i. p. 37.

Caulis basi breviter pseudobulbosus, subglobosus, vaginis tectus; folia 4–5 angusta linearia lanceolata acuminata stricta, 3–6 uncias longa, $\frac{1}{8}$ unciam lata; scapus gracillimus subteres, $1\frac{1}{2}$-pedalis, pro maxima parte omnino nudus; racemus multiflorus laxus $2\frac{1}{2}$ uncias longus; flores minimi "flavo-brunnei"; pedicelli $\frac{3}{16}$ unciam longa, bracteæ lanceolatæ minutæ; sepalum posticum lanceolatum

obtusum, lateralia latiora ovata lanceolata falcatula; petala angusta linearia filiformia; labellum cuneatum oblongum bilobum, breve carnosulum, callis obscurissimis.

Cambodia, Angkow Thom and Bayoc, island of Phuquoc, *Godefroy-Leboeuf!*

15. L. ABYSSINICA, *Richard, Tentamen Floræ Abyssinicæ*, vol. ii. p. 281.—Sturmia abyssinica, *Reichb. fil. in Walp. Ann.* iii. p. 527.

Pseudobulbus squamis laxis obtectus; caulis 3–4-uncialis; folia sæpius bina rarius tria, ovalia acuta vel ovali-oblonga; racemus pauciflorus; flores purpurascentes; bracteæ ovales lanceolatæ acuta, ovario æquales; sepalum posticum lanceolatum obtusiusculum trinervium, lateralia pendula ultra mediam partem coalita, semiovalia obtusa; petala longiora linearia; labelli basis erecta semicanaliculata, lamina linguiformis obtusa crassa integra supra basin carunculata.

Abyssinia prope Adoua, *Quartin Dillon* (non vidi).

16. L. DISEPALA, *Reichb. fil. in Linnæa*, xli. p. 97.

Ultra pedalis, vultus omnino *L. elatæ*. Folia angustiora tria oblonga ligulata acuminata bene nervosa; scapus longus exsertus laxe racemosus; bracteæ triangulo-lineares parvæ, ovariis pedicellatis longe breviores; sepalum posticum ligulatum obtuse acutum, lateralia bene latiora connata bifida; petala linearia deflexa; labellum cuneatum oblongum retusum cum apiculo in medio, callo parvo lamelliformi subquadrato obscuro in medio apiculato; columna apice ampliata.

New Caledonia, *Vieillard, Deplanche.*

Omnes præcedentes, inter se plerumque valde affines, sectionem *Elatæ* formant, distinctæ labello unguiculato, bicalloso, et habitu.

17. L. ELLIPTICA, *Reichb. fil. in Walp. Ann.* vi. p. 218; *Grisebach, Flor. Brit. West Indies*, p. 612.—L. Lindeniana et Galeottiana, *Hemsley in Gard. Chron.* 1879, i. p. 559.—L. jamaicensis, *Lindl. ex Griseb. Cat. Pl. Cub.* p. 261.—Cymbidium vexilliferum, *Llave & Lex. Nov. Veg. Descr.* fasc. ii. p. 11.—Malaxis Galeottiana et Lindeniana, *Rich. Ann. Sc. Nat.* sér. 3, iii. p. 18.—Sturmia elliptica, *Reichb. fil. in Linnæa*, xxii. p. 833; *Bonplandia*, ii. p. 22.

Pseudobulbus ovatus semiuncialis, folia vaginante tectus; folium singulum erectum oblongum lanceolatum acutum, $3\frac{1}{2}$–4 uncias longum, $\frac{3}{4}$ unciam latum; scapus anceps 5-uncialis; racemus compactus 12–30-florus; bracteæ foliaceæ lanceolatæ acuminatæ

semiunciales ovariis æquales; flores mediocres purpurascentes, "luridi" (*Llave*), "atropurpurei" (*Galeotti*); sepalum posticum lineare obtusum, lateralia lanceolata obtuso labello supposita; petala angustissime linearia, sepala lateralia paullo superantes; labellum ovatum obtusum marginibus undulatis, lateribus versus apicem emarginatis, ecallosum, vena mediana elevata, versus basin ramos duos laterales emittens; columna arcuata gracilis, alis parvis brevibus obtusis; anthera parva ovata truncata apice emarginata.

West Indies, Jamaica, *Macfadyen*!

Mexico, Vera Cruz, *Galeotti*; Mirador, *Linden* 199!

Guatemala, *Bernoulli* 290!, *Skinner*!

Colombia, *Moritz* 889; Banos in Pastis, *Spruce*! Venezuela, Lagunitans, *Moritz* 1973! Caripe, *Moritz* 625! Cumana, *Funcke* 675! Caraccas, *Wagener*. Santa Martha, *Purdie*!

British Guiana, Watu Ticaba, *Schomburgk*!

Species in regione Americana-australi equatorea, ut videtur vulgaris, variabilis, florum dimensionibus varians.

18. L. CAMPESTRIS, *Barb. Rod. Gen. & Sp. Nov. Orch.* i. p. 36.

Pseudobulbi minimi obovales, bracteis vestiti monophylli; folium oblongum acutum erectum semiplicatum; spica multiflora; caulis trigonus duplo major foliis; bracteæ oblongæ acutæ ovario duplo major foliis; sepala linearia oblonga obtusa, lateralia largiora; petala linearia; labellum oblongum subtrilobum, apice acutum cum linea in centro elevato desinente in callum bidentatum; columna semiarcuata, apice bidentata; flores flavovirescentes.

Brazil, Caldas et St. Paul, *Rodriguez*, *Regnell*.

19. L. CLYPEOLUM, *Lindl. Gen. & Sp. Orch. Pl.* p. 29; *Nadeaud, Flor. Tahit.* p. 86.—Epidendrum clypeolum, *Forster, Prodr.* no. 323.—Cymbidium clypeolum, *Willdenow*, no. 22.

Radices copiosæ lanatæ; pseudobulbus biuncialis vaginis albis membranaceis laxis tectus; folium singulum orbiculatum basi cucullatum patens, 4 uncias longum et æquilatum; scapus gracilis teres 6-uncialis parte majore inferiore nudo; racemus laxus; flores mediocres circiter 8; bracteæ minimæ; sepala et petala anguste linearia patentia; labellum magnum tenue orbiculatum integrum; columna parum arcuata gracilis.

Society Isles, *Bidwill*! Tahiti, *Forster*! *Moseley*! Samoa, *Powell*! Arue, *Nadeaud*.

20. L. CUSPIDATA, n. sp.—Pusilla; caulis vix pseudobulbosus, vaginis 2–3 tectus; folium singulum tenue late ovatum, 2 uncias

longum, $1\frac{1}{2}$ latum; scapus inferne nudus gracilis angulatus 3-unciale; bracteæ brevissimæ; flores 6–8 mediocres, pedicellis longiusculis gracilibus suberectis; sepala anguste linearia, petala subsimilia angustiora; labellum tenue patens cordatum cuspidatum pallidum, linea media obscuriora $\frac{1}{4}$ unciam longum; columna gracilis curvula, alis parvis.

Society Islands, Tahiti, *Collie and Lay*! *Herb. Brit. Mus.*

Planta habitu præcedentis, sed minor labello cuspidato. In itinere Beecheyano lecta, sed adhuc prætermissa.

21. L. AURICULATA, *Miq. Prolusio Fl. Jap.* p. 135 (1866), *non Reichb. fil.*

Pseudobulbus ovatus, vaginis laxis tectus; folia bina ovata rotundata petiolata; petiolus basi paullo dilatatus, $1\frac{1}{2}$ uncias; lamina 2 uncias longa, $1\frac{1}{2}$ lata, 8-nervia; scapus erectus 6-uncialis, angulatus nec alatus; flores circiter 10 erecti iis *L. Loeselii* majores in racemo terminali laxo; bracteæ lanceolatæ acutæ quam pedicelli dimidio breviores, $\frac{1}{8}$ unciam longæ; sepala ligulata lanceolata obtusa recurva, petala linearia; labellum cuneatum obovatum minute dentatum, $\frac{2}{8}$ unciam longum linea media (in sicco) discolori macula obscura ad basin paullo incrassata; columna arcuata gracilis, alis parvis quadratis.

Japan: Nippon, *Tschonoski*!

22. L. HAWAIENSIS, *Mann, Proc. Amer. Acad.* vii. p. 207; *Wawra, in Flora,* 1875, p. 246.

Pseudobulbus parvus; folia bina ovalia vel oblonga obtusa membranacea plicata petiolata, lamina $2\frac{1}{2}$–4 uncias longa, 1–$2\frac{1}{2}$-uncialis lata, petiolus circiter uncialis; scapus angulatus, folia bis superans; racemus pluriflorus; sepala lanceolata lateralia margine revoluta, petala filiformia; labellum obovatum integerrimum vel crenatum flavidum 3 lineas longum; capsula obovata clavata costata.

Sandwich Isles, *Mann & Brigham, Wawra, Hillebrandt*!

23. L. VIRIDI-PURPUREA, *Griseb. Cat. Pl. Cub. Wright*, p. 261.

Caulis vix pseudobulbosus uncialis; folia bina ovata elliptica acuta petiolata, 3–4 uncias longa, $1\frac{1}{2}$–2 lata subdissita; scapus 3–6-uncialis angulatus; racemus pauciflorus laxiusculus; bracteæ $\frac{1}{8}$-unciales, lanceolatæ acuminatæ; sepala linearia ligulata rufescenti-viridia, petala angustiora; labellum cordatum ovatum subacutum, "purpureum."

Cuba, *Wright* 1691!

24. L. ARNOGLOSSOPHYLLA, *Reichb. fil. in Bonplandia*, 1856, p. 217.—Ophrys rotundifolia, *Ruiz, MSS.*

Folium inferius 3–4-unciale oblongum acutiusculum horizontale prope 3 pollices latum, superius dimidium minus; bracteæ lineari-lanceolatæ, pedicellis subæquales; scapus $3\frac{1}{2}$-uncialis alatus; racemus $2\frac{1}{2}$-pollicaris; flores quam iis *L. liliifoliæ* paullo minores minus tenues; petala linearia, nec subulata; labellum oblongum acutiusculum nec cuneatum obovatum apiculatum.

Central America, New Spain, *Ruiz*; "exstat specimen unum diphyllum," non vidi.

25. L. RUPESTRIS, *Griffith, Notulæ*, iii. p. 276.—L. rostrata, *Reichb. fil. in Linnæa*, xli. p. 44.

Pseudobulbus $1\frac{1}{2}$-uncialis parum dilatatus laxe vaginatus; folium 1 rarius 2 tenue late ovatum acutum repandum ("glaucum," fide *Griffith*) 4 uncias longum, 3 uncias latum, 18-nervium; scapus brevis gracilis nutans, 4–6-uncialis, angulatus alatus, racemus laxiusculus pluriflorus; bracteæ minimæ ovatæ lanceolatæ; flores mediocres virides, pedicellis longis erectis tenuibus; sepala linearia reflexa; petala angustiora subsimilia; labellum porrectum oblongum obtusum, apice minute emarginatum cuspide minute; columna cycnicollis arcuata, apice incrassata, alis obtusis; capsula semiuncialis elliptica.

Assam, Khasia, Nunklow, *Griffith*! *Hooker & Thomson*! N.W. India, *Royle*! *Thomson*!

Var. PURPURASCENS, n. var.—Labellum pallide obscure purpureum; folia bina subpetiolata.

Lachen, Sikkim, *J. D. Hooker*!

26. L. GLOSSULA, *Reichb. fil. in Linnæa*, xxi. p. 43.

Pseudobulbus ovoideus, caulis pauci-vaginatus monophyllus; folium cuneatum oblongum obtuse acutum seu obtusum; scapum angulatum, foliis longior seu æqualis; racemus pluriflorus; bracteis lanceis ovaria pedicellata infima dimidio æquantibus; sepala lineari-lanceolata, petala linearia; labellum basi columnam amplexum, utrinque angulo retrorso cuneata, basi brevissima oblonga obtusa apiculata ecallosa; columna basi et apice dilatata; flores iis *L. ellipticæ* simulantes sed *L. liliifoliæ* æquales.

Ind. or.

Hanc plantam nescio, an *L. rupestris*, Griff., diversa?

27. L. BEDDOMEI, n. sp.—Caulis uncialis vix bulbosus; folia bina rarius terna ovata lanceolata acuminata, 1 unciam longa, $\frac{1}{2}$ unciam lata; scapus gracilis biuncialis angulatus; racemus laxus

pauciflorus; bracteæ lanceolatæ acuminatæ uninerviæ 1 linea longæ; flores parvi, pedicellis gracilibus suberectis 3 lineas longis; sepala angusta ligulata linearia; petala angustissime linearia acuminata; labellum planum tenue oblongum rotundatum obtusum viride macula purpurea in medio; columna gracillima arcuata, alis minimis; anthera ovata obtusa.

Southern India, Shembanganoor, Pulney mountains, 5000 feet alt., *Beddome*! *in Herb. Brit. Mus.*

28. L. LILIIFOLIA, *Richard, Mém. Mus. Par.* iv. p. 52; *Sprengel, Syst. Veget.* iii. p. 740; *Lindley, Orch. Pl.* p. 28; *et Bot. Reg.* t. 882; *Torrey, Fl. New York*, ii. p. 271; *Chapman, Flor. U. S.* p. 454; *So Mokou Soussetz*, xviii. p. 67, fig. A; *Franchet & Savatier, Flor. Jap.* ii. p. 21; *Asa Gray, Bot. Jap.* p. 409.—Ophrys liliifolia, *Linn. Sp. Pl.* 946; *Redouté, Liliac.* t. 437.—O. trifolia, *Walt. Fl. Carol.* p. 221.—Malaxis liliifolia, *Swartz. Act. Holm.* 1800, p. 235; *Elliot, Bot. S. Carol. & Georg.* ii. p. 503; *Nuttall, Gen. Amer. Pl.* ii. p. 196; *Andrews, Rep.* t. 65; *Pursh, Flor.* ii. p. 592, t. 2004; *Bot. Cab.* t. 198; *Ehret, Phil. Trans.* liii. t. iv. p. 81.

Pseudobulbus ovoideus, vaginis ampliatis membranaceis; folia bina ovata obtusa, 1½–5 uncias longa, 2½ uncias lata; scapus 3½–8-uncialis, infra nudus; racemus laxus 12–30-florus; bracteæ parvæ ovatæ acutæ quam pedicelli multo breviores; sepala linearia obtusa, petala linearia angustissima viridia; labellum cordatum oblongum integrum breviter mucronatum ecallosum purpurascenti-viride; columna gracilis arcuata medio angustata, alis brevibus; ovaria et pedicelli graciles patentes purpurei.

N. America, Philadelphia, *Nuttall*! Buffalo, N. Y., *Clinton*! Cincinnati, *J. Clark*! Virginia, *Clayton*! Missouri, *Letterman*!

Japan, Nippon and Yeso, Hakodate, *Wright*!

29. L. KRAMERI, *Franchet & Savatier, Flora Jap.* ii. pp. 22, 509; *So Mokou Soussetz*, xviii. p. 68, fig. D.

Pseudobulbus parvus, iis *L. Loeselii* similis; folia bina ovata vel ovata lanceolata spathulata subacuta crispula, 2½ uncias longa, ¾ lata; scapus gracilis alatus 4–8-uncialis (rarius multo minor biuncialis, foliis ½-uncialibus); flores pauci ad 9 flavescenti-virides laxi; bracteæ ovatæ lanceolatæ minutissimæ; sepala angusta lineari-lanceolata acuminata, lateralia ¼ unciam longa, labellum superantes; petala angustiora linearia acutissima; labellum geniculatum basi angustatum, callo magno subcylindrico apice eroso ad basin, ad geniculationem carinis duabus in lamina labelli attenuatis; lamina ovata longe cuspidata, margine minute

dentato; columna crassiuscula parum curva, alis brevibus erectis cornutis; alabastra acuminata.

Japan, Nippon, *Tschonoski*! *Kramer*.

30. L. Bowkeri, *Harvey*, *Thes. Cap.* ii. p. 7, t. 109.

Caulis breviusculus 1–½-uncialis; folia sæpius bina evoluta ovata acuta tenuia haud petiolata, 4 uncias longa, 1½ uncias lata; scapus debilis angulatus et brevissime alatus 4 uncias longus; bracteæ ⅜-unciales ovatæ acuminatæ virides; flores ochracei ad 15 laxe racemosi, pedicellis longiusculis; sepalum posticum anguste lanceolatum obtusum, lateralia elliptica lanceolata latiora et falcata obtusa, venis 4 prominulis, labello subæqualia; labellum unguiculatum ungue brevi, lamina ovalis rotundata obtusa obscure crispula, nervis prominulis præsertim medianis; calli duo perparvi subconici; columna gracilis arcuata basi dilatata, alis brevibus obtusis; anthera ovata subacuta.

S. Africa: Caffraria, Kreili's country, *Harvey*! Grahamstown, *Atherstone*! Natal, *Gerrard*! Kai Kloof, *Saunders*!

31. L. ornithorrhynchos, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 460, differt labello ovato-cordato, venis haud prominulis; callis nullis, anthera acuminata, floribus virescentes.

S. Betsileo, Madagascar, *Hildebrandt*! *Deans Cowan*!

32. L. ochracea, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 461, differt a præcedente ungui labelli longiori, lamina abrupta deflexa oblonga obtusa macula ochrea in mediis (eo *L. reflexæ* similis), foliis pluribus.

Ankafana, Madagascar, *Deans Cowan*!

33. L. connata, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 462. Insignis sepalis connatis, reliquas perianthii includentibus, venis elevatis et conspicuis, labello crenulato, callis duobus, forsan est monstrum. Affinis *L. Bowkeri*, sed præter alia, foliis pluribus diversa.

Madagascar.

34. L. longicaulis, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 461. Differt caule elatiore tenui, vaginis albescentibus membranaceis pluribus tecto; scapo elato gracili; labello oblongo crenulato.

Madagascar, Ankafana, *Hildebrandt*! *Deans Cowan*!

35. L. puncticulata, *Ridl. in Journ. Linn. Soc., Bot.* xxii. p. 119, habet caulem 10-uncialem altum tenuem, vaginis albescentibus membranaceis, dissitis, puncticulatis; labello bilobo, lobis denticulatis divaricatis.

Madagascar, *Baron*!

36. L. flavescens, *Lindl. Bot. Reg.* sub t. 882; *et Orch. Pl.* p. 29; *Spreng. Syst. Veg.* iii. p. 741; *Ach. Richard, Orch. Maur.* p. 51; *S. Moore, Flor. Maur. & Seych.* p. 342; *Boj. Hort. Maur.* p. 320.—Malaxis flavescens, *Thouars, Orch. Iles Afr.* t. 25.

Rhizoma diu repens; caulis biuncialis haud incrassatus, vaginis albescentibus ampliatis tectus; folia bina ovata lanceolata breviter petiolata, 2 uncias longa, 1 unciam lata; scapus exalatus 4-uncialis pro majore parte floriferus; bracteæ lanceolatæ acutæ foliaceæ; pedicelli erecti; racemus pluriflorus laxus; flores iis *L. ornithorrhynchi* minores; sepala lateralia falcata lanceolata, labello supposita, posticum ligulatum; petala linearia; labellum vix ultra $\frac{1}{8}$ unciam longa, quam sepala multo brevius, subcordata rotundata lata apiculata, venis conspicuis; callus unicus linguiformis; columna breviuscula curvula.

Madagascar, *Lyall*! *Fox*! Mauritius, *Bojer*. Seychelles, *Horne*! Bourbon, *Thouars*.

37. L. Eggersii, *Reichb. fil. in Ber. Bot. Gesellsch.* iii. p. 278.

Affinis *L. flavescenti*. Usque spithamea; folia gemina seu terna cuneato-oblonga acuminata medium pedunculum non attingentia; pedunculus præsertim inter inflorescentiam anceps, sub inflorescentia pauci ac distanter vaginatus purpureus usque 5-florus; bracteæ triangulæ pedicellos nunc subæquantes deflexæ; sepalum posticum ligulatum obtuse acutiusculum lateralia latiora breviora ovata acuta subcurva; petala filiformia apice latiora obtusa spathulata deflexa; labellum ligulatum antice dilatatum, bilobum basi bicorniculatum; columna apice bidentata, membrana cingente postica humili emarginata. Dimensiones *L. Loeselii* fortis.

West Indies, *Baron Eggers*.

38. L. polycardia, *Reichb. fil. in Flora*, 1885, p. 543.

Ultra pedalis; caulis basi vix tumidus, vaginis amplis acutis membranaceis vestitus; folia genuina oblonga acuta membranacea $2\frac{1}{2}$ uncias longa, $\frac{3}{4}$–1 unciam lata; scapus elongatus laxiflorus; bracteæ in basi probabiliter fatuæ majores cordato-lanceolatæ, superiores veræ subæquales minores, ovarii pedicellato dimidio ferme æquantes; sepalum posticum lineare, ligulatum, lateralia falcato-ligulata; petala filiformia: labellum cuneatum flabellatum dilatatum antice emarginatum, marginibus anticis crenulatis; callus depressus forcipatus in basi (sc. lamina antrorsum bicuspidata); columna arcuata apice et basi incrassata.

Regio Africana austro-orientalis, sine loco speciali aut collec-

tore. Non vidi, probabiliter est *L. puncticulata* affine, sed folia pauciora, etc.

39. L. LONGA, *Reichb. fil. in Linnæa*, xli. p. 97.

Caulis elatus subteres, basi paullo incrassato vaginatus; folia genuina subopposita oblonga acuminata; scapus racemosus exsertus inferne subnudus squama una hic inde, bracteæ semilanceæ subuninerviæ (nervo sc. unico tantum evoluto), ovariis pedicellatis subæquales; sepala ligulata obtusa lateralia et petala linearia subfalcata; labelli pars basilaris angusta utrinque semicordata paullo dilatata in partem anticam latissimam obtusangulo subquadratum, antice medio bilobum; callus depresso-bidentatus in basi; columna arcuata apicem versus dilatata.

Hanc plantam, cujus locum natalem non dixit auctor, nescio.

40. L. CAPENSIS, *Lindl. in Ann. Nat. Hist.* ii. 1840, p. 314.—Sturmia capensis, *Sonder in Linnæa*, xix. p. 71.

Semipedalis; pseudobulbus parvus cum caule 1–1½-uncialis, vaginis albis membranaceis laxis tectus; folia bina, late ovata obtusa vel acutiuscula patula, 1–1½ uncias longa, ¾–1 unciam lata; scapus erectus crassiusculus angulatus, 1–3-uncialis, multiflorus; flores parvi congesti; bracteæ lanceolatæ acuminatæ, pedicellis æquales, ¼–½-unciales; sepalum posticum angustum lineare oblongum, lateralia oblonga obtusa falcatula; petala angusta linearia quam lateralia longiora; labellum quam sepala brevius trilobum, lobis lateralibus perparvis obtusis, lobus medius oblongus apice rotundato; marginibus carnosulis; columna erecta angusta, apice curvo, alis brevibus obtusis; capsula oblonga elliptica, ¼-uncialis.

South Africa: prope Rondebosch, *Bolus* no. 4598! Cape Town, *Bolus* 4552! Zwellendam, *Bowie*! *Zeyher* 3887!

41. L. LOESELII, *Richard, Mém. Mus. Par.* iv. p. 52; *Spreng. Syst. Veget.* iii. p. 740; *Lindl. Gen. & Sp. Orch. Pl.* p. 28; *Illustr. Orch. Pl. Genera*, t. ii.; *Bot. Reg.* t. 882; *Syme, Eng. Bot.* ix. p. 133, t. 1488.—L. Correana, *Spreng. Syst.* iii. p. 740.—Ophrys Loeselii, *Linn. Sp. Pl.* 947; *Eng. Bot.* no. 47.—O. liliifolia, *Huds. Fl. Angl.* p. 389.—O. paludosa, *Muell. in Flora Danica*, t. 877.—Malaxis Loeselii, *Swartz, Act. Holm.* 1800, p. 235; *Smith, Eng. Flora*, iv. p. 48; *Willdenow*, no. 8.—M. Correana, *Barton, Prodr. Flor. Philad.* p. 86; *Nuttall*, ii. p. 196.—M. longifolia, *Barton, Flor. N. Am.* iii. p. 12, t. 75.—Sturmia Loeselii, *Reichb. fil. Ic. Fl. Germ.* t. ccccxcii.; *Ic. Bot.* cmlvi.; *Koch, Syn. Fl. Germ. & Helv.* ed. 2, p. 803.

Pseudobulbus ovatus, vaginis albescentibus membranaceis

tectus; folia bina oblonga, lanceolata obtusa vel subacuta flaccida 1–3 uncias longa, ½–1 lata; scapus folia superans acute triqueter, 3–8 rarissime 13-uncialis (specimen Canadense); racemus laxus, flores 3–20 parvi erecti flavescenti-virides; bracteæ parvæ lanceolatæ acutæ, pedicellis æquales; sepala angusta lineari-lanceolata obtusa 3 lineas longa; petala linearia; labellum obovatum oblongum integrum vel obscure trilobum apiculatum marginibus plus minus crenulatis; columna brevis crassiuscula ferme recta, alis brevibus; anthera ovata obtusa, stigma quadratum; capsula oblonga elliptica erecta, costis prominulis, ferme ½-uncialis.

Europe, central; Sweden, Ostrogotha, *Blytt*! *Holmgren*! Gotland, *Nyman*. Norway, *Borgeby*, *Hallbeck*. Denmark. Eastern England: Norfolk, Suffolk, Cambridge, Hants, Kent? Belgium. Holland. Schleswig-Holstein, *Hansen* 281! Ins. Mohn. Germany: Mecklenburg, *Wüstrei*!; Hamburg; Bavaria, *Schultz*, Herb. Norm. ii. 147, 147 *bis*; Leipzig, *Auerswald*! France: Dunkirk, *Woods*!; Dessine près Lyon, *Bonnamour* in Billot herb. 3238! Tyrol, Bozen, *Grabmayr*! Hungary, Epenet, *Haslinsky*! Switzerland, Vevey, *Leresche*!; Geneva, *Meisner*! Transylvania. Russia: Lithuania, *Besser*!

Eastern N. America: New York, Buffalo, *Clinton*!; Hastings County, Lake Ontario, *Macoun*!; Washington, Falcon Valley, *Suksdorf*!; Philadelphia, *Barton*!; Massachusetts, Cambridge, *Nuttall*!; Virginia, *Clayton*!

42. L. JAPONICA, *Maximowicz*, *Bull. Ac. Imp. St. Pétersb.* xii. p. 544.—Microstylis japonica, *Miq. Prolus. Fl. Jap.* p. 135; *Franch. & Sav. Enum. Pl. Jap.* ii. p. 21.

Caulis pseudobulbosus sed paullo dilatatus, 1½-uncialis; rhizoma validum et suberosum; folia bina ovata obtusa, 2–3 uncias longa, 1⅛ lata; scapus sexuncialis conspicue alatus; flores 7–8 laxe racemosi erecti virescentes; bracteæ minutæ ovatæ obtusæ; pedicelli breves, cum ovariis, ½ unciam longi; sepala lanceolata ligulata obtusa, petala linearia; labellum obovatum cuneatum ecallosum breviter cuspidatum marginibus minute crenulatis; columna ferme cycnicollis gracilis, basi dilatata, alis brevibus latis rotundatis.

Japan: Hakodate, *Maximowicz*! Mandshuria austr., *Radde*, *Maximowicz*.

43. L. CAMPYLOSTALIX, *Reichb. fil. in Linnæa*, xli p. 43.

Pseudobulbus tunicatus; caulis paucivaginatus diphyllus; folia cuneata oblonga acuta; scapus angulatus folia bene superans racemosus; bracteæ triangulæ minutæ; flores iis *L. Loeselii* æquales

sepala linearia lancea; petala linearia; labellum basi columnam amplexum utrinque angulum retrorsum obtusangulum pentangulum antice retusum ecallosum; columna bene curva antice juxta foveam ampliata.

India oriens, locus specialis ignotus.

44. L. SAUNDERSIANA, *Reichb. fil. in Gard. Chron.* 1872, p. 1003.

Pusilla; caulis brevis pseudobulbosus; pseudobulbus globosus $\frac{1}{3}$-uncialis; folia bina ovalia cordata acuta quorum unum majus, unciam longa, $\frac{3}{4}$ unciam lata; scapus 2–3-uncialis, purpurascens breviter alatus debilis; flores parvæ 8–9 in racemo laxo; bracteæ lanceolatæ virides, $\frac{1}{8}$ unciam longæ, pedicellis purpureis haud multo breviores; sepala angusta ligulata viridia, petala angustiora filiformia purpurea; labellum ellipticum oblongum obtusum, vel minute apiculatum, $\frac{1}{4}$ unciam longum, purpureum; columna gracilis cycnicollis, basi dilatata; anthera purpurea.

Jamaica, *Morris*! v. s. et v. cult. in hort. Kew.

45. L. WENDLANDII, *Reichb. fil. Orchid. Wendland.* p. 98.

Humilis; caulis 2–1-uncialis, vaginæ pseudobulbi externæ suberosæ; folium cuneatum late ovatum acutum; racemus circiter 13-florus subsecundus nunc quaquaversus pluriflorus; flores virides; sepala ligulata obtuse acuta; petala linearia; labellum basi utrinque minutissime retrorsum auriculatum, late ligulatum, antice dilatatum emarginatum, toto limbo minute serrulata; lineoli callosi terni breves a basin disci; columna humillima.

Costa Rica, *Wendland.*

46. L. GUINGANGÆ, *Reichb. fil. in Flora,* 1867, p. 103.

Pusilla, triuncialis; pseudobulbus minutus globularis; caulis brevissimus; folia bina lanceolata mucronata patula, $\frac{1}{2}$ unciam longa, 2 lineas lata; scapus gracilis angulatus; racemus pauciflorus; bracteæ lanceolatæ acuminatæ vel ovatæ, $1\frac{1}{2}$ lineam longæ; flores parvi ex albido pallide flavescentes; pedicelli erecti $\frac{1}{4}$ lineam longi; sepalum posticum angustum lineare $\frac{1}{4}$-unciale, lateralia ovata falcatula, labello æquales; petala linearia angusta quam ovarium longiora; labellum ovatum apiculatum; columna gracilis erecta, apice incurva; ovarium $\frac{1}{4}$-unciale oblongum ellipticum.

West Africa: Huilla, Morro de Monino, *Welwitsch* no. 723!

47. L. LUTEA, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 458, differt a præcedente foliis angustis, pedicellis erectis, bracteis lanceolatis, 2–3 in scapi parte inferiore dissitis; sepalis ovatis falcatis; est etiam planta omnino major. Madagascar!

48. L. XANTHINA, n. sp.—Pseudobulbus ovalis conicus, vaginis tectus, superioribus foliaceis; folia bina lanceolata ovata subobtusa; scapus gracilis, bracteis dissitis lanceolatis; racemus multiflorus laxus; flores circiter 13, parvi, flavi; bracteæ inferiores pedicelli dimidio æquales, superiores breviores; pedicelli graciles, subpatuli; sepalum posticum angustum lineare, lateralia ovata oblonga obtusa; petala angustiora linearia; labellum oblongum obtusum; columna crassiuscula parum curva.

Madagascar: Ankafana in arboribus, *Deans Cowan*!

49. L. PARVA, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 462.—A *L. xanthina*, Ridl., differt floribus olivaceis nec flavis, sepalis lateralibus lanceolatis nec ovatis. Planta pusilla Madagascarica.

50. L. GERRARDI, *Reichb. fil. in Flora*, 1867, p. 118.

Caulis paullo dilatatus uncialis; folia 3–4 angusta lanceolata ligulata acuta, basi longe angustata flaccida, 3 uncias longa, $\frac{3}{8}$ unciam lata; scapus erectus gracilis subteres, exalatus, 6-uncialis; racemus laxus pauciflorus; bracteæ lanceolatæ acuminatæ virides, $\frac{1}{4}$ unciam longæ; pedicelli longi tenues; sepala ligulata oblonga subacuta; petala filiformia angusta; labellum obovatum acutum, callis minutis duobus ad basin.

Natal, *Gerrard*!

51. L. LONGIPETALA, *Ridl. in Journ. Linn. Soc., Bot.* xxi. p. 459.

Habitu *L. Gerrardi* habet, sed pseudobulbus est distinctus, sepala lateralia late semicircularia, labellum oblongum obtusum breve, petala longiora.

Madagascar.

52. L. TRICALLOSA, *Reichb. fil. in Gard. Chron.* n. s. xiii. p. 684.

Caulis vix pseudobulbosus, breviusculus; folia 3–5, late lanceolata plicata petiolata; scapus 9–12 uncias longus angulatus; racemus laxus multiflorus; sepala lanceolata ligulata obtusa; petala filiformia; labellum ovatum breviter unguiculatum, lamina obtusa tenuis marginibus denticulatis, venis rufescentibus, unguis brevissima erecta lateribus incrassatis atro-rubris; callus singulus mamilliformis obtusus albus; columna suberecta, apice incrassata curva, alis magnis obtusis latis, basi kermesina; pedicellus gracilis longus; bracteæ minimæ lanceolatæ; capsula erecta elliptica.

Borneo; Buut Island, Sooloo, *Burbidge*!

53. L. BRACHYGLOTTIS, *Reichb. fil.*; *Trimen, Syst. Cat. Ceyl.* p. 87.

Planta pusilla, 3–6-uncialis; caulis biuncialis, basi dilatatus; folia 1–2 ovata acuta marginibus crispis, 2 uncias longa, 1 lata;

scapus brevis gracilis; flores parvi, laxe racemosi; bracteæ ovatæ lanceolatæ, pedicelli breves graciles; sepalum posticum lanceolatum viride, lateralia ovata labello supposita, basibus adnatis, quam labellum breviora; petala linearia; labellum oblongum obtusum emarginatum, marginibus paullo incrassatis; callo unico lato brevi emarginato ad basin; columna brevis crassiuscula erecta.

Ceylon, Wattakeele Hill, *Thwaites* no. 4002!

54. L. BARBATA, *Lindl. Orch. Pl.* p. 27.

Planta pusilla, 2–4-uncialis; caulis vix pseudobulbosus vaginis laxis tectus; folia bina ovata flaccida patentia, 2 uncias longa, 1 lata; scapus brevis angulatus; racemus laxus pauciflorus; bracteæ breves acutæ, pedicelli sublongi; flores parvi virides; sepala lanceolata obtusa recurva; petala anguste linearia obtusa; labellum oblongum cuneatum, basi in medio depresso, vel potius sulcato, hispidum; columna erecta, parum curvula, alis rectis obtusis, apice dilatata.

Ceylon, *Macrae*! (specimen singulum in herbario Lindleyano nec cl. Thwaitesio, unquam reperta).

55. L. BILOBA, *Wight, Icones*, vi. p. 1633; *Reichb. fil. in Walp. Ann.* vi. p. 218.

Pusilla; caulis $\frac{3}{4}$-uncialis basi in pseudobulbo ($\frac{1}{4}$-uncialis) dilatata; folia bina vel terna ovata acuta undulata petiolata, unciam longa, $\frac{1}{2}$–$\frac{3}{4}$ unciam lata; scapus nutans, $1\frac{1}{2}$ unciam longus, superne laxe racemosus; flores parvi purpurei pauci; bracteæ $\frac{1}{4}$ unciam longæ, lanceolatæ; sepala lanceolata ovata acuta, lateralia vix falcata; petala anguste linearia obtusa; labellum ungue brevi, lamina cuneata biloba, laciniis lanceolatis obtusis; calli duo; anthera ovata; columna arcuata, alis parvis obtusis. Planta omnino purpurascens.

Southern India, Ootacamund, *Wight*!

56. L. JOVIS-PLUVII, *Parish & Reichb. f. in Trans. Linn. Soc.* xxx. p. 155.

Pseudobulbus obconicus, vaginis pallidis demum fibris reductis tectus, 1–3 uncias longus; folia 3–4 ovata lanceolata acuminata, albo-tessellata, 3 uncias longa, $1\frac{1}{2}$ lata; petiolus aliquando uncialis; scapus 7-uncialis exalatus, basi nudus; racemus multiflorus; flores parvi purpurascentes; bracteæ anguste lineares lanceolatæ tandem deflexæ $\frac{1}{8}$ unciam longæ; sepala linearia, petala angustiora filiformia; labellum ad columnam ungue adnatum, lamina cordata acuta; columna breviuscula, alis quadratis.

Moulmein, Iwakabin, *Parish*!

57. L. Walkeriæ, *Graham in Bot. Mag.* t. 3770; *Thwaites, Enum. Pl. Ceyl.* p. 295.

Caulis vix pseudobulbosus 2½-uncialis, vaginis purpurascentibus tectus; folia terna ovata, 2 uncias longa, 1½ lata, petioli ¾-unciales; scapus gracilis erectus, 3½-uncialis, bracteis vacuis 1–2 dissitis, superne laxe racemosus; flores parvi plures; sepala oblonga acuta purpurea, lateralia vix obliqua, petalis multo latiora; petala linearia angusta purpurea; labellum oblongum, suborbiculare integrum crenulatum, deflexum viridi-purpureum; calli duo conici; columna breviuscula crassiuscula, paullulo curva, alis parvis subacutis.

S. India, Nilgherries, *Wight* no. 2946! Ceylon, *Thwaites* no. 2736!

58. L. montana, *Lindl. Orch. Pl.* p. 29; *Miq. Flor. Ind. Bat.* iii. p. 621.—Malaxis montana, *Blume, Bijdr.* p. 388.

Caulis biuncialis vix pseudobulbosus, vaginis pallidis membranaceis tectus; folia quaterna ovata longe acuminata acuta petiolata marginibus crispis, 3 uncias longa, 1½ lata, petiolis uncialibus; scapus gracilis angulatus 7-uncialis; racemus laxus terminalis; flores parvi; bracteæ anguste lanceolatæ acuminatæ 2 lineas longæ quam pedicelli multo breviores; sepala lanceolata ligulata obtusa lateralia subobliqua; petala linearia quam sepala longiora; labellum late obovatum, marginibus dentatis serratis, lateribus ad basin revolutis; callus ad basin obtusus; columna breviuscula crassiuscula parum curva basi dilatata, alis latis obtusis hyalinis.

Java, Pangerango mt., *Zollinger* no. 387; *Lobb* 194! *Blume*.

59. L. pectinata, n. sp.—Caulis vix pseudobulbosus, vaginis tectus 2-uncialis; folia pauca ovata acuminata, 3½ uncias longa, 1½ lata; scapus subteres exalatus 4-uncialis (vix tamen evolutus); racemus laxus; flores parvuli; sepala lanceolata subobtusa, similia; petala ligulata acuminata; labellum panduratum marginibus apicis inflexis pectinatis; calli duo conici in basin labelli; columna suberecta parum curva, alis latis obtusis crenulatis.

Philippines, *Cuming*! Specimen singulum in herbario Lindleyano, Kew.

60. L. atropurpurea, *Lindl. Orch. Plants*, p. 28; *Thwaites, Enum. Plant. Ceyl.* p. 295.—L. olivacea, *Wight, Icones*, t. 903 (*haud Lindley*).—L. Walkeriæ, *Wight, Ic.* t. 905 (*haud Graham*). —L. livida, *Lindl. in Royle Ill. Herb. Himal.* p. 364.

Caulis 5-uncialis basi paullo dilatato, vaginis laxis tectus; folia terna vel quaterna sæpius remotiuscula ovata petiolata 9-nervia crispa, 3–6 uncias longa, $2\frac{1}{2}$ lata, petiolo unciali; scapus teres 9-uncialis, bracteis vacuis lanceolatis pluribus munitus; flores in racemo congesto terminali pauci mediocres; bracteæ $1\frac{1}{2}$ lineas longæ pedicelli dimidio æquales; sepala purpurea anguste oblonga lanceolata, lateralia vix falcatula, obtusa, quam labellum longiora; petala purpurea linearia angustiora; labellum porrectum oblongum ovatum obtusum, marginibus crenulatis; calli breves duo subconici obtusi; columna crassiuscula parum curva, alis brevibus obtusis; anthera ovata obtusa, apice papillis viridibus ornato.

Southern India: Pulney Mountains, *Wight*; Travancore, *Beddome*! Anamallay Mountains, *Beddome*! Ceylon, *Macrae*! *Thwaites* no. 3181! *Gardner* no. 846! *Maxwell, &c.*

Northern India: Khasiya, *Lobb*! Mussooree, *Royle*! (v. ic. in Hb. Kew.).

L. livida, Lindl., differt ut videtur solummodo in labello magis rotundato et floribus magis congestis.

61. L. Wightiana, *Thwaites, Enum. Pl. Ceyl.* p. 295.—L. atropurpurea, *Wight, Icones*, t. 904, *non Lindl.*

Caulis brevis vix uncialis, vix pseudobulbosus, vaginis albis membranaceis laxis tectus; folia pauca 2–3 ovata lanceolata, margine crispa basi cordata, 1–$2\frac{1}{2}$ uncias longa, $\frac{3}{4}$–1 lata; petioli unciales; scapus erectus angulatus; bracteis paucis parvis dissitis 3–12-uncialis; flores pauci in apice scapi congesti mediocres, iis *L. nepalensis* ferme æquantes tenues, viridi-purpurascentes, pedicellis $\frac{1}{3}$-uncialibus; bracteæ lanceolatæ acuminatæ lineales; sepala oblonga acuta; petala linearia marginibus revolutis; labellum orbiculare vel suborbiculare planum, integrum vel minute retusum, $\frac{1}{4}$ unciam longum, callo lunato ad basin; columna exalata gracilis arcuata.

Ceylon, *Thwaites* no 3179! Southern India; Courtallum? *Wight*.

62. L. nepalensis, *Lindl. Bot. Reg.* t. 882; *Orch. Pl.* p. 28; *Sprengel, Syst. Veg.* iii. p. 741.—Malaxis cordifolia, *Smith in Rees's Cyclop.*—Acianthus petiolatus, *Don, Prodr. Nep.* p. 28.

Rhizoma longe repens, crassiusculum, caulibus sæpe longe remotis vix pseudobulbosis, vaginis 1–2 et petiolorum basibus dilatatus tectus; folia bina ovata cordata acuminata flaccida, lamina $3\frac{1}{2}$ uncias longa, $2\frac{1}{2}$ lata, petiolus biuncialis; scapus 4–6-uncialis angulatus; bracteæ plures anguste lanceolatæ acuminatæ,

superne comosæ, 3 lineas longæ; racemus laxus; flores mediocres virescenti-albidi, pedicellis 5 lineas longis; sepala angustata lanceolata linearia acuminata; petala angustiora; labellum porrectum oblongum ovatum longe cuspidatum ecallosum; columna gracilis arcuata, basi paullo dilatata, alis parvis subacutis.

Nepaul, Sheopore, *Wallich* no. 1945! *Wight* no. 109! Darjeeling, E. Bengal, *Griffith*! Kumaon, *Atkinson*.

63. L. REPENS, *mihi*.—Malaxis atropurpurea, *Blume, Bijdr.* p. 390.—Platystylis atropurpurea, *Lindl. Orch. Pl.* p. 18.—Apatales purpurascens, *Blume, MSS. in herb. Brit. Mus.*

Rhizoma diu repens, pseudobulbi parvi plures dissiti ovato-oblongi, semiunciales; folia singula rarius bina, ovata acuta petiolata, lamina $1\frac{1}{2}$ uncias longa, $\frac{3}{4}$ unciam lata, petiolus uncialis; scapus folia superans, 4-uncialis, angulatus; bracteæ plures lanceolatæ acuminatæ carinatæ superne comosæ $\frac{1}{4}$-unciales; flores mediocres pauci in apice scapi congesti atro-purpurei, pedicellis gracilibus; sepala lanceolata; petala anguste linearia; labellum oblongum cuspidatum 2 lineas longum; columna gracilis arcuata, alis brevibus.

Java, *Lobb* no. 193! Mt. Prahu, *Horsfield*! Mt. Salak, *Blume*!

64. L. STENOGLOSSA, *Parish & Reichb. fil. in Trans. Linn. Soc.* xxx. p. 154.

Caulis vix pseudobulbosus; folia 3–4 lanceolata acuta petiolata dissita, $1\frac{1}{2}$–3 uncias longa, 1 unciam lata, petiolus $1\frac{1}{2}$ uncias longus; scapus 4-uncialis, basi nudo, bractea hinc inde excepta; racemus laxus; flores plures dissiti parvuli purpurascentes; bracteæ lanceolatæ acuminatæ $\frac{3}{8}$-unciales; pedicelli $\frac{1}{2}$-unciales; sepala lanceolata ligulata lateralia, labellum superantia falcatula; petala filiformia; labellum ligulatum bilobum; columna gracilis arcuata, alis rotundatis brevibus.

Moulmein, *Parish*!

Habitus *L. purpurascentis*.

65. L. PURPURASCENS, *Lindl. Bot. Reg.* sub t. 882; *Orch. Pl.* p. 29; *A. Richard, Orch. Maur.* p. 53; *Bojer, Hort. Maur.* p. 320. —Malaxis purpurascens, *Thwaites, Orch. Iles Afr.* tt. 26, 27.

Caulis 1–3-uncialis haud pseudobulbosus purpurascens; folia bina rarius trina, vix petiolata dissita ovata cordata subacuta crispa, 2 uncias longa, $1\frac{3}{4}$ lata; scapus brevis uncialis vel $1\frac{1}{2}$-unciales purpurascens angulatus; racemus multiflorus subdensus; bracteæ lanceolatæ pedicellis subæquales, $\frac{1}{4}$ unciam longæ;

flores purpurei parvi; sepala lorata ligulata, lateralia labello supposita; petala linearia; labellum unguiculatum, ungue brevi suberecto, lamina cordata quadrata dentata, emarginata cum apiculo; columna breviuscula subclavata curvula apice incrassata, alis grandiusculis; capsula $\frac{1}{4}$ unciam longa conica clavata erecta.

Mauritius, *Bouton*! *Blackburn*!

66. L. NEUROGLOSSA, *Reichb. fil. Xenia Orchidacea*, iii. p. 26.

Rhizoma diu repens, eo *L. nepalensis* similis sed gracilibus, caules erectos, basi vaginis albescentibus membranaceis ampliatis tectos emittens; folia singula, cordata orbicularia crispula petiolata; petiolus $1\frac{1}{2}$-unciales, scapi basin amplectens, lamina $1\frac{1}{2}$ uncias longa, $1\frac{1}{2}$ lata, quo latissima; scapus debilis biuncialis angulatus; racemus laxus pauciflorus; flores parvi $\frac{1}{4}$ unciam longi, tenues; bracteæ ovatæ acutæ acuminatæ vel lanceolatæ foliaceæ, quam pedicelli dimidio breviores; sepala linearia ligulata, petala angustiora; labellum panduratum apice lato cuspide mediano brevi, venis tribus elevatis purpureis conspicuis; columna gracillima arcuata (in sicco aurantiaca), alis nullis; capsula elliptica oblonga erecta.

Bolivia: inter Laripata et Cani; Queliguaya prope Sorata, *Mandon* no. 1136!

67. L. WELWITSCHII, *Reichb. fil. in Flora*, 1865, p. 184.

Rhizoma repens, caules erectos haud pseudobulbosos 3 uncias altos emittens; folia 3–4 dissita ovata obtusiuscula petiolata, lamina $1-1\frac{1}{2}$ uncias longa, $1\frac{1}{4}-\frac{3}{4}$ lata; petioli semiunciales canaliculati vaginantes, vaginis ampliatis membranaceis; scapus 2–4-uncialis angulatus purpureus; bracteæ cordatæ ovatæ membranaceæ longe acuminatæ pedicellis æquilongæ; racemus $1\frac{1}{2}$-uncialis densiflorus; flores plures minimi; sepala ovata lanceolata lateralia multo latiora ovata oblonga, labello æqualia; petala linearia sepalis subæqualia, omnia obtusa atro-purpurea; labellum breve cordatum obtusum carnosulum, atro-purpureum margine albido, ecallosum; columna parum curva semiteres, crassiuscula exalata, stigma profundum; anthera obtusa; capsula elliptica circiter $\frac{1}{4}$-uncialis. Habitus ferme *Goodyeræ*.

Angola: Golungo Alto, *Welwitsch* no. 660!

Ramosæ.

68. L. CRISPIFOLIA, *Reichb. fil. in Linnæa*, xli. p. 43.

Caulis repens, folia dissita ovata subacuta, crispa petiolata,

lamina 2 uncias longa, $1\frac{1}{2}$ lata, petiolus $\frac{3}{4}$-uncialis; scapus erectus brevis, triuncialis, racemus pluriflorus; flores magni speciosi; bracteæ lanceolatæ acuminatæ, $\frac{2}{3}$ pedicelli æquales; sepala et petala anguste linearia acuminata reflexa semiuncialia verosimiliter viridia, petala angustiora; labellum $\frac{5}{8}$ unciam longum, $\frac{3}{8}$ latum, rhomboidale acuminatum, atro-purpureum, venis multis obscurioribus, ecallosum; columna gracilis cycnicollis, alis brevibus obtusis.

Peru, *Jameson*!

69. L. BRACHYSTALIX, *Reichb. fil. in Linnæa*, xli. p. 43.

Caulescens, caulis teres undique foliatus 5–6-uncialis; folia copiosa ovata petiolata subdissita, petiolis vaginantibus brevibus, laminis 9 lineas longis, 5 latis, marginibus crispis; racemi multiflori laxi laterales ex axilla foliorum superiorum orientes $4\frac{1}{2}$-uncialis, rhachide subtereti; bracteæ lanceolatæ foliaceæ crispæ, ovariis subæquales; sepala et petala linearia ligulata reflexa angusta "brunnea," petala angustiora; labellum oblongo-cordatum retusum cuspidatum, 4 lineas longum, viride, linea mediana obscuriore; columna brevissima crassiuscula erecta quam unguis labelli brevior, alis nullis.

Ecuador: in valle Lloensi ad arborum truncos 9000 ped. alt. No. 449, *Jameson*!

70. L. RAMOSA, *Poeppig & Endlicher, Nov. Gen. et Sp.* ii. p. 9, t. 112.

Rhizoma diu repens, crassiusculum bipedale, ramosum; folia remota, secunda (internodiis uncialibus) erecta, petiolata, petiolus $\frac{1}{2}$ unciam longa, lamina $1\frac{1}{2}$ uncias longa 1 unciam lata, quo latissima, ovata cordata subacuta; scapus subterminalis, 6-uncialis, ferme omnino racemosus; flores "albi," plures; sepala ligulata, $\frac{1}{4}$ unciam longa; petala angustiora linearia subæqualia, omnia reflexa viridia (ex Poeppig); labellum porrectum, $\frac{1}{4}$ unciam longum, ellipticum obcuneatum apiculatum; columna brevissima, arcuata, subgracilis, $\frac{1}{4}$ labello æqualis.

Venezuela: Tovar, *Fendler* no. 1422! Tolina prope Oyucar, *Goudot*! Peru: Pampayaco, *Poeppig*.

Valde affinis *L. brachystalice*, Reichb. f., sed omnino maior.

71. L. WAGENERI, *Reichb. fil. in Bonplandia*, iii. p. 78.

Folia violacea plantaginea geminata subpetiolata, lamina ovalis acuta basi cuneata rotundata, petiolus lamina æqualis vel brevior; racemus spithameus basi nudus; flores iis *L. latifoliæ* æquales,

albi, sepala et petala linearia; labellum cuneatum flabellatum margine denticulato; bracteæ quam ovario ter breviores.

Colombia: San Pedro, Ocana, *Wagener* (non vidi).

Species hujus sectionis haud satis notæ.

L. ALATA, *Scheidweiler, in Otto & Dietr. Allgem. Gartenz.* 1842, p. 293; *Lindl. Bot. Reg.* 1843, *Misc.* no. 12 (*non Richard*).

Folia 6, oblongo-ovata acuta petiolata, plicata, quam spica erecta multiflora breviora; scapus erectus squamosus 6-uncialis purpureus, alis 6 membranaceis; sepala et petala linearia; labellum mucronatum revolutum atro-purpureum; columna viridis; flores ½ unciam longæ, purpurea, labello kermesino.

Mexico, culta ad Lacken a rege Belgiorum.

L. TRADESCANTIFOLIA, *Lindl. Orch. Pl.* p. 29.—Malaxis tradescantifolia, *Blume, Bijdr.* p. 389.

Bulbi compressiusculi vaginati monophylli; folio ovata discolora membranacea; bracteæ minutæ ovatæ; labelli limbus ovatus integerrimus; sepala subæqualia patentia; labellum sepalis paullo latius basi callosum; antheræ loculi subdisjuncti.

Java, in umbrosis Mt. Salak, October, *Blume.*

Anne *Microstylis commelynifolia,* Reichb. f.?

§ CORIIFOLIÆ.

Herbæ gerontogeæ tropicæ plerumque epiphyticæ rarius rupicolæ, pseudobulbis incrassatis, foliis paucis lanceolatis spathulatis, marcescentibus caducis, quasi pseudobulbis articulatis.

72. L. GRANDIFLORA, *Ridl. Journ. Bot.* xxii. 1884, p. 333.

Pseudobulbus adhuc deest, ...; folium singulum magnum, 8 uncias longum, 2½ latum, ovatum lanceolatum costatum; scapus crassiusculus teres pedalis, pro majore parte laxe racemosus; flores magni remoti; pedicellis gracilibus uncialibus; bracteæ lanceolatæ acutæ vix ½ pedicellorum æquales; petala et sepala ligulata lanceolata obtusa angusta, viridescentia, petala angustiora; labellum cuneatum obovatum trilobum, crenulatum, marginibus pubescentibus ¾ unciam longum, et quo latissimum ½ unciam latum, ochrea linea mediana obscuriore; columna curva gracilis basi paullo dilatata, alis brevibus rotundatis latis; anthera obscure viridis depressa obtusa.

Borneo, Mindai-Pramassan, *Grabowsky*! *Everett*!

Flores in genere maximi.

73. L. CRENULATA, *Lindl. Gen. & Sp. Orch. Pl.* p. 30; *Miq. Fl. Ind. Bat.* iii. p. 623.—Malaxis crenulata, *Blume, Bijdr.* p. 393.

Pseudobulbus 2–3-uncialis cylindrico-conicus; folium singulum vel 2, lanceolatum acutum, 12-costatum, 8–10 uncias longum, 1½–2¼ latum; scapus teres, ferme omnino racemosus 7–8 uncias longus; flores mediocres "obscure aurantiaci" dissiti; pedicelli unciales, patuli; bracteæ lanceolatæ foliaceæ ½ unciam longæ; sepala lanceolata obtusa; petala subsimilia angustiora; labellum 5 lineas longum et latum, cordatum obovatum bilobum, lobis crenulatis; columna arcuata gracilis, alis brevibus obtusis.

Java, *Lobb* 307! Gede, *Zollinger* no. 3122! *Junghuhn* no. 295; *Blume.*

Var. SUMATRANA.—Bracteæ lanceolatæ triangulares acuminatæ breviores; pedicelli breviores, callus parvus ad basin labelli.

Sumatra, *Forbes* 3102! *in Herb. Brit. Mus.*

74. L. LATIFOLIA, *Lindl. Gen. & Sp. Orch. Pl.* p. 30; *Reichb. fil. in Gard. Chron.* 1885, April 25, p. 532; *Miq. Fl. Ind. Bat.* iii. p. 623.

Pseudobulbus pyriformis 1½–3½ uncias longus, radicibus gracilibus; folium singulum lanceolatum acutum, 6–8 uncias longum, ¾–1 unciam latum, erectum sæpe scapum superans; scapus multiflorus 6–7-uncialis; racemus laxiusculus; "flores aurantiacæ;" bracteæ lanceolatæ acutæ pallidæ pedicellos superantes superne comosæ, ⅓-unciales; sepala elliptica ovata lanceolata obtusa; petala linearia obtusa; labellum cuneatum bilobum, marginibus dentatis; columna gracilis arcuata, alis obtusis; anthera ovata rotundata obtusa; capsula ovata vix ½ unciam longa pyriformis.

Java: Tankabar, 410 F, Salak, 3117, *Zollinger*! 304, *Junghuhn*! 1079. S.E. Java, *H. O. Forbes*! *Lobb* 170!

75. L. FORBESII, n. sp.—Pseudobulbus brevis conicus ½-uncialis, vaginis membranaceis laxis tectus, superioribus foliaceis; folium singulum exacte lanceolatum acutum petiolatum semipedale, ferme unciam latum; scapus gracilis angulatus, anguste sed conspicue alatus, 8-uncialis; racemus laxus circiter 12-florus; bracteæ breves lanceolatæ acuminatæ 1 lineam longæ; pedicelli patentes 6 lineas longi; flores quam iis latifoliæ minores; sepala lanceolata ligulata obtusa, lateralia falcatula; petala linearia angustissima; labellum late obovatum, oblongum emarginatum, callis duobis parvis hemisphæricis ad basin; columna brevis

crassiuscula parum curva, alis linearibus ligulatis obtusis; costæ ovarii sinuatæ; capsulæ pyriformes $\frac{1}{4}$-unciales nutantes.

S.E. Java, 1153*a* *H. O. Forbes*! *Herb. Brit. Mus.*

76. L. CHLOROXANTHA, *Hance in Journ. Bot.* 1883, p. 231.

Planta 8-pollicaris, radicibus dense pilosis; pseudobulbi ovoidei teretes 9 lineas longi, vaginis 4 tecti; folia bina lineari-lanceolata acuminati 6 pollices longa, 9 lineas lata, 5-nervia, nervo medio subtus prominulo; scapus valde compressus anceps; bracteæ bifariæ lineari-subulatæ acutissimæ, inferiores ad 8 poll. (sic, potius lin.?) longæ, florales 3 lineales; racemus 15–20-florus, 4 poll. longus; flores 4 lin. longis adhuc clausi virides, expansi luteoli; sepala lateralia oblonga obtusa recurva, posticum filiforme patens; petala filiformia patentia; labellum late depresso-orbiculatum arcte revolutum, basi bituberculatum, margine superiore denticulato ipso apice ex emarginatura dense obtuso terminato; columna margine edentato.

Hongkong, Mount Parker, et terra firma, *Ford*: non vidi.

77. L. LACERATA, n. sp.—Pseudobulbi aggregati oblongi conici; folia bina, ligulata spathulata acuta 6 uncias longa, $\frac{1}{2}$ unciam lata; scapus longior crassiusculus laxe racemosus; flores mediocres dissiti; bracteæ breves lanceolatæ; sepala et petala ochroleuca, lanceolata ligulata; petala angustiora; labellum ungue brevis, lamina oblonga quadrata deflexa apice laciniata, laciniis circiter 10 acutis, ochroleuca, macula mediana aurantiaca; columna gracilis curvula, alis parvis.

Borneo: Lawas River, *Burbidge* (*v. icon.*) *in Herb. Brit. Mus.*

Planta hæc habitum *L. reflexæ* habet, sed foliis binis labello apice laciniato facile distinguenda.

78. L. BECCARII, n. sp.—Rhizoma diu repens; pseudobulbi valde (3 uncias) dissiti, baculiformes recti vix incrassati, biunciales; folia dissita 3, lanceolata obtusa basi angustata costata, 7 uncias longa, $\frac{5}{8}$ unciam lata; scapus subteres 9-uncialis, basi bracteis paucis dissitis exceptis nudus; racemus laxus circiter 15-florus; flores mediocres, pedicellis gracilibus $\frac{3}{4}$-uncialibus; bracteæ lanceolatæ lineares, $\frac{1}{2}$ unciam longæ; sepala lanceolata subobtusa $\frac{2}{8}$ unciam longa, lateralia labello supposita, latiora subfalcata; petala linearia filiformia; labellum ungue erecto, lamina oblonga elliptica, biloba, lobis rotundatis quadratis, minute denticulatis; columna gracilis arcuata, alis brevibus.

Sumatra: Mount Singalan, *Beccari* no. 380! *in Herb. Kew.*

79. L. DIODON, *Reichb. fil. in Linnæa*, xli. p. 43.

Folium longe spathulatum carnosum membranaceum oblongum obtusum; scapus angulatus longe nudus, apice racemosus; bracteæ minutæ; sepala linearia; petala filiformia; labellum basi cuneatum utrinque angulatum dein dilatatum subquadratum antice crenulatum cum apiculo; columna gracilis arcuata basi bidentata; anthera mutica.

India, Dehra Doon, cult., *Wilson Saunders*.

80. L. PLICATA, *Franchet, Enum. Pl. Jap.* vol. ii. pp. 22, 509; *So Mokou Soussetz*, vol. xviii. p. 22.

Pseudobulbus oblongus conicus ferme uncialis, vaginis membranaceis 4 laxis tectus, superiore acuminata; folium singulum lanceolatum acutum, 5 uncias longum, 1 latum, costis tribus conspicuis; scapus erectus 6-uncialis vel paullo ultra, complanatus conspicue alatus, superne racemosus; bracteæ lanceolatæ acuminatæ, pedicellis ferme æquantes; flores mediocres dissiti erecti vel patentes; sepala lanceolata obtusa vix falcatula; petala linearia angusta; labellum unguiculatum ecallosum, lamina cuneata obovata, paullisper retusa, nonnunquam cuspide mediano minuto; columna crassiuscula erecta, alis brevibus latis subquadratis.

Japan, cult. in hortis Yedoensibus, *Franchet*! Hongkong, 521 *Fortune? herb. Lindl.*!

81. L. BOOTANENSE, *Griffith, Ic. Pl.* cclxxxvii.; *Notulæ*, iii. p. 278; *Itinerary Notes*, ii. p. 98.

Rhizoma sæpe diu persistens, pseudobulbi approximati, vaginis viridibus tecti, 1½ uncias longi; folia singula rarius bina lanceolata acuminata plicata, sæpius basi longe angustata, 6 uncias longa, ¾ lata; scapus gracilis alatus, 9-uncialis; racemus laxus; flores remoti, mediocres, pallide flavo-virides et ochrei; bracteæ lineari-lanceolatæ acuminatæ, inferiores ⅜, superiores vix ⅛ unciam longæ; pedicelli ½-unciales patentes; sepala lanceolata ligulata angusta; petala filiformia; labellum cuneatum retusiusculum, basi unguiculatum; columna gracilis cycnicollis, alis triangulis.

Bootan, Durunga, *Griffith* 1460! Churra, Pomrang, *Hooker & Thomson*, Liparis, 18!

82. L. GRIFFITHII, n. sp.—Pseudobulbus sub anthesin vix distinctus, foliis vaginantibus 4 tectus; folia evoluta 1–2 spathulata lanceolata ad basin angustata plicata, 6 uncias longa, 1½ lata;

scapus brevior validulus, late alatus; racemus brevis compactus; flores parvi plures; bracteæ lanceolatæ acuminatæ foliaceæ, pedicellis æquales; sepala lanceolata, lateralia labello supposita vix falcata; petala linearia; labellum integrum ovatum cuneatum crenulatum; columna gracilis arcuata.

Bootan? *Griffith* 5069! *in Herb. Kew.*

Habitus *L. plicatæ*, sed flores multo minores congesti, pedicellis brevibus.

83. L. Mannii, *Reichb. fil. in Flora*, 1872, p. 275.

Dense cæspitosa; pseudobulbus plurivaginatus vagina summa elongata acuminata, ipse cylindraceus vix pollicaris monophyllus; folium chartaceum lineari-lanceolato-acuminatum; pedunculus anceps apice longius ac minus racemoso; bracteæ setaceæ ovaria pedicellata infima superantes, summa longe non æquantes; sepala linearia ligulata obtusa acuta; petala angustiora; labelli trifidi laciniæ laterales semifalcatæ, isthmo brevissimo angusto, lacinia antica transverso ovata antice crenulata; anthera acuta; columna utrinque superne ampliata.

Assam, Obres, *Mann*: non vidi.

84. L. cœlogynoides, *F. Muell. Fragm. Fl. Austral.* ii. p. 71; *Benth. Fl. Austral.* vi. p. 273.

Pseudobulbi conici ovoidei approximati parvi, semiunciales, vaginis pallidis tecti; folia erecta 1–2, circiter 3-uncialia, raro pedalia angusta lanceolata spathulata acuminata et versus basin angustata, $\frac{1}{2}$ unciam lata vel ultra, multinervia; scapus pedalis vel brevior anceps gracilis, aliquando subflexuosus; bracteæ virides lanceolatæ acutæ pedicellis tenuibus æquales; racemus laxus, pauciflorus; flores parvi tenues; sepala lanceolata acuta; petala linearia; labellum sepalis æquale membranaceum porrectum securiforme obtusum crenulatum flavescens; columna semiteres incurva; capsula clavata ellipsoidea.

Australia: Clarence River, *Beckler*!

85. L. plantaginea, *Lindl. Orch. Pl.* p. 29.—L. selligera, *Reichb. fil. in Linnæa*, xli. p. 42.—L. orbicularis, *Lodd., ex Hemsley in Gard. Chron.* n. s. xvi. (1881) p. 592.

Pseudobulbus oblongus cylindricus 2 uncias longus, vaginis lanceolatis acutis foliaceis tectus; folia evoluta bina, lanceolata plicata acuta cuspidata, iis *L. plicatæ* similia, 4–6 uncias longa, 1–1½ lata; scapus angulatus exalatus 8 uncias longus; racemus laxus, flores dissiti plures suberecti magni virides; bracteæ lan-

ceolatæ acuminatæ latiusculæ, $\frac{1}{3}$–$\frac{1}{2}$-unciales pedicellis æquales; sepala lanceolata ligulata, lateralia labello supposita; petala linearia patula; labellum latum integrum planum viride cuneatum rotundatum, marginibus obscure crenulatis, basi bicallosum, $\frac{3}{8}$ unciam longa et lata; columna suberecta longiuscula gracilis, alis latis brevibus paullisper decurvis; costæ ovarii sinuosæ.

India, locum specialem nemo dicit: v. sc. in hort. Kew. 1863, et icon. a Cathcartio et Royleo pictam in Herb. Kew.; sine dubio hæc est planta sub nomine *Cymbidi plantaginei*, Wallich, in Icones Mus. Angl. Ind. no. 633 depicta, etsi specimina in herbario Wallichiano desunt.

86. L. REFLEXA, *Lindl. Bot. Reg.* t. 882; *Reichb. fil. Beitr. Syst. Pflanzenk.* p. 46; *Benth. Fl. Austral.* vi. p. 272.—L. foliosa, *Lindl. Bot. Reg.* t. 882; *Lodd. Bot. Cab.* t. 1097; *Hooker, Bot. Mag.* t. 2709; *A. Rich. Orch. Maur.* p. 52; *Lindl. Orch. Pl.* p. 29.—L. decursiva, *Reichb. fil. in Gard. Chron.* 1884, July 12, p. 38.—Cymbidium reflexum, *R. Br. Prod.* p. 331.

Rupicola; pseudobulbus uncialis latus ovatus, aliquando plures seriatim aggregati; folia vaginantia 3–4, evoluta bina terna oblonga lanceolata acuta submucronulata erecta, 5 uncias longa, $\frac{1}{2}$ unciam lata; scapus 4–6-uncialis alatus; racemus laxus 16–20 florus; bracteæ lanceolatæ acuminatæ $\frac{1}{4}$-unciales, ovarii dimidio æquantes; flores mediocres; sepala lanceolata obtusa angusta; petala lineari-lanceolata subacuta, omnia recurva viridia; labellum ungue angustato, lamina oblonga obtusa deflexa, apice sæpius paullo emarginata, viride vel flavidulum, macula ochrea in medio; columna crassiuscula, apice curva, alis parvis; anthera ovata; capsula elliptica 5 lineas longa, pedicellus $\frac{1}{4}$-uncialis.

Australia: Port Jackson, *R. Brown*, 5506!; North Rocks, Port Jackson, *Caley*!

Specimen optimum vivum, quod accepi a cl. Moore, Hort. Glasnevin, 1885, sub nomine *L. decursiva*, Ind. or.! est omnino *L. reflexa*, R. Br.

Var. β. CUNEILABRIS.—L. cuneilabris, *F. Muell. Fragm. Fl. Austral.* iv. p. 164; *Benth. Fl. Austral.* vi. p. 273.—Sturmia angustilabris, *F. Muell. l. c.*

Flores paullo minores; folia acutiora et magis acuminata; bracteæ breviores; alabastra longiora et angustiora; calli duo conici ad basin labelli.

Queensland: Rockingham Bay, *Dallachy*! v. v. cult. Hort. Kew.

87. L. PACHYPUS, *Parish & Reichb. fil. in Trans. Linn. Soc.* xxx. p. 155.

Pseudobulbi crassi tumidi unciam alti circiter ½ in diametro, pyriformes; folia singula lanceolata acuta, 2 uncias longa, ½ unciam lata; scapus angulatus, paullisper alatus vix 3-uncialis, ferme omnino laxiuscule racemosus; bracteæ lanceolatæ ⅛ unciam longæ, quam pedicelli paullo breviores; flores parvuli virides; sepala anguste ligulata; petala filiformia; labellum cuneatum, subbilobum crenulatum basi bicallosum; columna gracilis suberecta, alis obscuris.

Moulmein, *Parish*!

88. L. GROSSA, *Reichb. fil. in Gard. Chron.* 1883, vol. i. p. 27.

Pseudobulbus brevis crassus pyriformis diphyllus; folia ampla lato ligulata obtusa apicibus inæqualibus; racemus sursum pluriflorus, rhachide depressa ima basi vagina nunc acuta foliacea compressa, sursum vaginis acuminatis scariosis pluribus, flores brunnescentes flavi; bracteæ lineari-cuspidatæ, ovariis pedicellatis vix æquales; sepala ligulata acuta, petala linearia; labellum ima basi minute utrinque obtuse auriculata ligulata medio abrupte constricto antrorsum divergenti bilobo, lobis lateralibus quadratis extrorsis margine externo denticulatis; calli obscuri subevanidi gemini in basi; columna albo-virescens.

Burma, introd., *H. Low.*

Affinis *L. pachypodæ*, sed multo major, foliis latissimis obtusis et labello diverso.

89. L. BISTRIATA, *Parish & Reichb. fil. in Trans. Linn. Soc.* xxx. p. 155.

Pseudobulbi elongati subcylindrici 2 uncias longi; radices copiosæ graciles; folia bina patentia elliptica oblonga obtusa 2 uncias longa, 1 lata; scapus gracilis angulata exalata, 3 uncias longa; racemus laxiusculus multiflorus; bracteæ lanceolatæ pallidæ pedicellis æquales; flores parvuli virides lineis duabus brunneis ad basin labelli; sepala ligulata angusta; petala linearia filiformia; labellum lineari-panduratum apice retuso denticulato; columna cycnicollis, alis parvis.

Moulmein, *Parish*!

90. L. HOOKERI, n. sp.—Pseudobulbi oblongi ovati crassi ¾ unciam longi; folia bina spathulata lanceolata acuta, multinervia, 3 uncias longa, ¾ unciam lata; scapus debilis (aliquando crassiuscula) complanatus alatus, 4½ uncias longus; flores plures, resu-

pinati iis *L. bistriatæ* majores; bracteæ lanceolatæ acutæ, ¼ unciam longæ, pedicellis subæquales; sepala lanceolata ligulata; petala linearia angustiora; labellum unguiculatum, lamina deflexa oblonga subquadrata obtusissima; columna gracilis cycnicollis subclavata basi dilatata.

Khasiya, Mamloo (*Liparis* 17), *J. D. Hooker! in Herb. Kew.*

Affinis *L. bistriatæ*, sed pseudobulbo diverso, labello integro oblongo.

91. L. VIRIDIFLORA, *Lindl. Orch. Pl.* p. 31; *Thwaites, Enum. Pl. Ceyl.* p. 295.—L. elliptica, *Wight, Icones*, v. 1735.—L. Wightii, *Reichb. fil. in Walp. Ann.* vi. p. 218.—Malaxis viridiflora, *Blume, Bijdr.* p. 392, t. 54.

Pseudobulbi ovato-globosi unciales aggregati; folia bina elliptica spathulata, 2 uncias longa ¾ unciam lata; scapus angulatus, 6–8 uncias longus; racemus subdensus subsecundus, flores parvi inaperti 40–20; bracteæ lanceolatæ acuminatæ, floribus subæquales; sepalum posticum ovatum lanceolatum, lateralia lanceolata erecta; petala subæqualia linearia obtusa; labellum ovatum cucullatum acutum marginibus crispulis; columna suberecta, alis parvis obtusis.

Nilgherries, *Wight.* Upper Assam! *sine collectore, in Herb. Kew.* Ceylon, *Macrae*! Hautane, *Champion, Thwaites* no. 3178. Java, *Blume, Lobb*!

Planta hæc habitum *L. pachypodis* habet, sed est insignis ob flores inapertos verosimiliter cleistogamos.

92. L. LUTEOLA, *Lindl. in Wall. Cat.* no. 1944; *Orch. Pl.* p. 32; *Griffith, Notulæ*, iii. p. 277.

Cæspitosa; pseudobulbi parvi subglobosi, seriatim approximati; folia bina lineari-lanceolata acuta mucronulata angusta 2 uncias longa vix ⅛ unciam lata; scapus alatus, 4-uncialis; racemus pauciflorus laxus sæpe flexuosus; bracteæ lanceolatæ acuminatæ; flores parvi dissiti ochracei-flavi; sepalum posticum lanceolatum obtusum lateralia latiora falcatula, labello supposita; petala linearia deflexa; labellum oblongum obovatum obtusum, callis conicis duabus ad basin; columna gracilis arcuata, basi et apice dilatatis; capsula pyriformis globosa, ¼ unciam longa, pedicello æqualis.

India: E. Bengal, Churra Pungee, Nullah, *Griffith*!; Mt. Pundooah, *Wallich*! no. 1944; Assam, *Griffith*!; Khasiya, *Lobb*!

93. L. REVOLUTA, *Hooker, Bot. of Beechey's Voyage*, p. 70, t. 16.

Pseudobulbi semiunciales, oblongi conici, seriatim approxi-

mati, vaginis laxis tecti; folia singula ensiformia lanceolata spathulata obtusa, $2\frac{1}{2}$ uncias longa, $\frac{1}{2}$ lata; scapus 4-uncialis inferne late alatus superne ferme teres, bracteis vacuis dissitis paucis; racemus laxus multiflorus; flores parvi; bracteæ lanceolatæ longe acuminatæ ovariis ferme æquantes; sepala lanceolata acuta; petala linearia angustiora; labellum ovatum integrum subacutum, lamina deflexa; columna crassiuscula curvula exalata; anthera ovata; capsula ovato-globosa, cum pedicello $\frac{1}{4}$ unciam longo.

Society Islands, Tahiti, *Collie*!

94. L. CÆSPITOSA, *Lindl. Bot. Reg.* sub t. 882; *Gen. & Sp. Orch. Pl.* p. 32; *Richard, Orch. Maur.* p. 53; *Boj. Hort. Maur.* p. 321; *S. Moore, Flor. Maur. & Seych.* p. 342.—L. angustifolia, *Lindl. Gen. & Sp. Orch. Pl.* i. p. 31; *Thwaites, Enum. Pl. Ceyl.* p. 296.—Malaxis cæspitosa, *Thouars, Orch. Iles d'Afr.* t. 90.—M. angustifolia, *Blume, Bijdr.* p. 393; *Miq. Fl. Ind. Bat.* iii. p. 622.

Cæspitosa; pseudobulbi $\frac{1}{4}$ unciam longi, seriatim approximati, vaginis pluribus laxis; folia 1–3, scapis subæqualia, $1\frac{1}{2}$–$3\frac{1}{2}$ uncias longa, $\frac{1}{4}$–$\frac{3}{16}$ lata, lanceolata subspathulata acuta mucronata; scapus compressus alatus, 2–3-uncialis; racemus laxiusculus pluriflorus; flores virescentes minuti; bracteæ lineares subulatæ flores superantes; sepala ovata lanceolata reflexa; petala anguste linearia reflexa; labellum oblongum obtusum, margine retuso dente minimo, nervi duo ad basin incrassati; columna arcuata gracilis, alis parvis obtusis; capsula parva ovata.

Mauritius, *Bojer*! *Bouton.* Bourbon, *Bernier*! Madagascar, *Deans Cowan*!

Ceylon, *Thwaites* no. 2351! *Gardner* 847!

Java, *H. O. Forbes* no. 914! Mt. Salak and Gede, *Blume.*

Sumatra, *H. O. Forbes* no. 2574 *b*, pars!

Platystylis. Pusillæ, cæspitosæ; pseudobulbi parvi angusti; folia subcoriacea; scapus teres vel valde compressus alatus flexuosus; flores parvi resupinati; labellum oblongum unguiculatum, callis nullis, venis ad basin laminæ incrassatis; columna recta, brevis, lata, alis 2 vel 4.

95. L. RESUPINATA, n. sp.—Pseudobulbi parvi $\frac{1}{2}$ unciam longi angusta, conico-cylindrica; folia dissita lanceolata acuminata versus basin angustata, 3 uncias longa, $\frac{1}{4}$ lata; scapus $4\frac{1}{2}$-uncialis, gracilis, ferme omnino laxe racemosus, subteres; bracteæ angustæ lanceolatæ acuminatæ 2 lineas longæ; flores parvi plures, flavovirides, pedicellis ferme 4 lineas longæ; sepalum posticum lan-

ceolatum obtusum marginibus minute papillosis, lateralia lanceolata obtuso-deflexa, marginibus convolutis; petala angusta linearia deflexa; labellum ungue erecto, lamina oblonga deflexa, obtusa quam sepala lateralia multo brevius; columna subrecta breviuscula parum curva, alis duabus grandiusculis.

India, Darjeeling, Khasiya, Mumbree, *Griffith*! *Lobb* 122! Sikkim, *Hooker*! Neilgherries, *Wight*!

96. L. AURITA, *Ridl. in Append. to Forbes's Naturalist's Wanderings in Eastern Archip.* p. 518.

Pseudobulbi parvi ovati approximati vix ½ unciam longi; folia linearia lanceolata subacuta basi angustata; scapus gracilis 4¼-uncialis teres, ferme omnino laxe racemosus; bracteæ ovatæ acutæ; flores parvi plures, aurantiaci; sepala obtusa lanceolata, petala linearia; labellum oblongum cuneatum apice trilobo, lobis subæqualibus brevibus angustis obtusis, lateralibus convolutis, venis duabus ad basin incrassatis costam hippocrepiformem formans; columna crassiuscula recta, alis brevibus latis obtusis, duabus multo minoribus extus; anthera ovata conico-depressa; capsula ⅛-uncialis subglobosa, pedicello ferme ¼ unciam longo.

Timor, Bibicucu, no. 3714, *H. O. Forbes*!

97. L. DECURRENS, *Reichb. fil.*—Platystylis decurrens, *Lindl. Orch. Pl.* p. 18.—P. alata, *Blume, MS. in herb. Brit. Mus.*—Malaxis decurrens, *Blume, Bijdr.* p. 390, t. 54.

Pseudobulbi cæspitosi, tenues vix incrassati, ferme cylindrici; folia bina lanceolata spathulata acuta versus basin angustata vix coriacea unciam longa, ⅜ lata; scapi vix 6-unciales, graciles compressi, flexuosi late alati; flores pauci dissiti, parvi resupinati; bracteæ lanceolatæ acuminatæ; sepala ovata obtusa, posticum erectum, marginibus omnium minutissime ciliata vel papillosa; petala filiformia ciliata; labelli ungue erecto, lamina oblonga cuspidata abrupte deflexa, lateribus ad basin laminæ elevatis tortisque; columna crassa, alis 4 carnosulis obtusis.

Java, Mt. Salak, *Blume*! *Zollinger*!

Khasiya, *Lobb*!

Distichæ. Racemi breves pauciflori, bracteæ distichæ majusculæ; flores tenues mediocres.

98. L. COMPRESSA, *Lindl. Gen. & Sp. Orch. Pl.* p. 32; *Miq. Flor. Ind. Bat.* iii. p. 621.—Malaxis compressa, *Blume, Bijdr.* p. 390, t. 54.

Pseudobulbus 2–2½ uncias longus, compressus; folium singulum, ensiforme acutum, carinatum, coriaceum 9 uncias longum, 1¼ latum; scapus compressus semipedalis gracilis alatus; racemus nutans 2-uncialis; bracteæ remotiusculæ; flores rubri "aurantiaci"; sepala lanceolata ¼ unciam longa; petala angustissima linearia; labellum obovatum suborbiculare, 4 lineas longum, et quo latissimum æquilatum, papillis duabus ad basin; columna breviuscula crassiuscula arcuata, basi et apice incrassata.

Java, *Lobb* no. 168!; Buitenzorg, Bantam, Tjanjor, *Blume.* Salak, *Zollinger* 680. Sumatra, Mt. Singalan, *Beccari*!

99. L. CUMINGII, n. sp.—Pseudobulbus adhuc abest; folium lanceolatum obtusum, apice mucronatum, 5 uncias longum, ½ latum; scapus 3–4½ uncias longus, gracilis compressus alatus; bracteæ approximatæ lanceolatæ carinatæ; flores tenuissimi, verosimiliter virescentes; sepala angusta linearia lanceolata, 3 lineas longa; petala angustissima linearia lanceolata paullo longiora; labellum obovatum obtusum margine minutissime crenulatum, papillis duabus brevibus obtusis in basin; columna gracilis arcuata, alis brevibus latis obtusis quasi quadratis; anthera ovata lata, apice obtuso; capsula elliptica ½-uncialis; pedicellus ¼ unciam longus, bracteæ æqualis.

Malacca, *Cuming* no. 2141! *in Herb. Brit. Mus.*

100. L. DISTICHA, *Lindl. Bot. Reg.* sub t. 882; *A. Rich. Orch. Maur.* p. 54; *Miq. Flor. Ind. Bat.* iii. p. 623; *Bojer, Hort. Maur.* p. 321; *Decne. Ann. N. H. Mus.* iii. p. 366.—L. gregaria, *Lindl. Gen. & Sp. Orch. Pl.* p. 33; *Moore in Bak. Fl. Maur.* p. 342; *Thwaites, Enum. Pl. Ceyl.* p. 296.—Malaxis disticha, *Thouars, Orch. Iles Afr.* t. 89.—Stelis micrantha, *Sieb. Herb. Maur.* ii. no. 168.—L. mucronata, *Lindley, Orch. Pl.* p. 32.—Malaxis mucronata, *Bl. Bijdr.* p. 391.

Rhizoma diu repens, pseudobulbi pyriformes remoti; folia singula, 8 uncias longa vix ½ unciam lata, lanceolata angusta acuta; scapus 6–10-uncialis tenuis anceps alatus; racemus 1–2-uncialis; flores tenues aurantiaci; bracteæ ovatæ acuminatæ carinatæ ovarii dimidio æquales; sepala lanceolata acuta; petala linearia subæquilonga; labellum obovatum emarginatum, cuspide medio brevi, marginibus ad basin inflexis; callus verrucosus; columna brevis antice complanata lata recta marginata paullisper curva, alis distinctis nullis.

Mauritius, *Sieber*! *Wallich*! *Macgregor* Bourbon, *Thouars.*

Ceylon, *Gardner*, *Macrae*! *Thwaites* no. 2359! *Moon*! 467, *Mrs. Walker*.

Moulmein, *Parish*!

Philippines, *Cuming* no. 2099!

Timor, *fide Decaisne*.

Densifloræ. Pseudobulbi conico-cylindrici vel baculiformes; vaginis paucis membranaceis ad basin tecti; folia subopposita, lanceolata vel spathulata, sæpius bina; racemus densiflorus, flores minimi virescentes, petala et sepala subsimilia, patentia vel recurva; labellum nec unguiculatum nec callosum.

101. L. LONGIPES, *Lindl. in Wallich's Plant. Asiat. Rar.* vol. i. p. 31, t. 35; *Gen. & Sp. Orch. Pl.* p. 40; *Wight, Icon.* no. 906; *Reichb. fil. in Bonplandia*, 1857, p. 57; *Thwaites, Enum. Pl. Ceyl.* p. 295; *Benth. Fl. Hongkong.* p. 352.—L. pendula, *Lindley, Bot. Reg.* 1838, *Misc.* p. 180; *Regel, Ind. Sem. Hort. Petrop.* 1868, p. 79.—L. elegans, *Lindl. in Wall. Cat.* no. 1943 (in parte); *Gen. & Sp. Orch. Pl.* p. 30.—L. nesophila, *Reichb. fil. Otia Hamb.* i. p. 56; *Xenia Orch.* iii. p. 31.—L. Boottii, *Regel, Ind. Sem. Hort. Petrop.* 1864, p. 14?

Pseudobulbus clavatus vel ferme cylindricus, 3–5½ uncias longus, vaginis paucis pallidis tectus, radicibus crassis lanatis; folia bina erecta vel recurva oblonga lanceolata acuta crassa, 6–8 uncias longa, ¾–1¼ lata; scapus erectus vel subnutans, sæpius inferne alatus; flores dense aggregati rhachin exalatum ferme omnino tegentes; bracteæ lanceolatæ acuminatæ membranaceæ, 1 lineam longæ; sepala lanceolata acuta; petala linearia, pallide virides (marcescentia albida); labellum oblongum ovatum recurvum integrum viride (marcescens aurantiacum); columna suberecta apice parum curva, crassiuscula, alis obscuris; anthera ovata; capsula obovata pyriformis vix ¼ unciam longa, pedicello æqualis.

India: Khasiya, 1000–3000 ft., Sikkim, 3000–5000 ft., *Hooker & Thomson*!; Nepal, E. Bengal, *Wallich*!; Churra, Khasiya, *Griffith*!; Courtallum, *Wight*!; Tinnevelly, *Beddome*!; Bootan, *Griffith* no. 107!; Ceylon, *Macrae, Thwaites* no. 3177!

China: Hongkong, Mt. Victoria, *Lamont*! *Harland, Champion* 335.

Java, *Zollinger* no. 777.

Samoa, *Whitmee*! Fiji Islands, *Horne*! *Seemann*!

Var. SPATHULATA.—L. spathulata, *Lindl. Bot. Reg.* 1842, p. 81, *Misc.* no. 189.

Pseudobulbis ovatus oblongus brevis, biuncialis; folia lanceolata spathulata; scapus brevior anceps; labellum magis ovatum subobtusum.

India, *Falconer*!; Khasiya, Sikkim, *Hooker & Thomson*!; Moulmein and Tavoy, *Parish*; Lakat Mts., *Wallich*!; Sadiya Mts., Assam, *Griffith*!

Planta variabilis sæpe culta. *L. elegans*, Lindl. in Wallich no. 1943, Penang (*Gen. Porter*), constat hæc species florifera et fructifera cum alia specie fructibus multo majoribus; flores nullos inveni, labello retuso ut dixit et pinxit Lindley in herbario suo, forsan floribus ullius speciei intermixtis.

102. L. PUSILLA, *mihi.*—L. auriculata, *Reichb. fil. in Flora*, 1872, p. 77, *non Miq.*

Subcæspitosa; pseudobulbus parvus ovatus conicus, $\frac{1}{3}$ unciam longus, vaginis albescentibus tectus; folia iis præcedentis similia sed minora singula spathulata lanceolata ferme 3 uncias longa, $\frac{1}{4}$ lata; scapus alatus 4-uncialis; racemus subdensus; flores minuti copiosi; bracteæ lanceolatæ acuminatæ, $\frac{1}{2}$–$\frac{2}{3}$ pedicellorum æquales; sepala et petala anguste lanceolata ligulata reflexa; petala angustiora; labellum oblongum panduratum obtusum angulis basalibus pone columnam paullo auriculatis; columna paullo arcuata, alis brevibus; anthera ovata obtusa.

India: Khasiya, *Hooker & Thomson*! Anamallays, *Beddome*!

103. L. CLAVIGERA, n. sp.—Pseudobulbi approximati elongati baculiformes 4 uncias longi, basi incrassato, vaginis laxis tecto, superne nudi; folia bina angusta lineari-lanceolata obtusa, 4–5 uncias longa, $\frac{1}{4}$ unciam lata, divaricata; racemus gracilis elongatus, circiter 4-uncialis, vagina laxa ad basin supra folia vix semiuncialis; flores remotiusculi minutissimi, iis *L. longipedis* simulantes; bracteæ angustæ lanceolatæ setaceæ; sepala ovata oblonga obtusa; petala anguste linearia; labellum ecallosum ovatum oblongum obtusum integrum; columna arcuata gracilis, basi dilatata, alis brevibus quasi quadratis; anthera ovata subobtusa.

Java, *Zollinger* no. 865! *in Herb. Brit. Mus.*

104. L. VESTITA, *Reichb. fil. in Flora*, 1872, p. 274.

Pseudobulbi appressi subteretes, baculiformes, juniores vaginis amplis vestiti, diphylli; folia cuneato-oblonga ligulata acuta;

scapus teretiusculus inferne nudus superne dense racemosus; bracteæ lanceolatæ ovariis subæquales; sepala ligulata, obtusa; petala filiformia; labellum oblongum retusum, nunc utrinque angulatum, antice crenulatum, ecallosum; columna basi et apice ampliata.

Assam, Obres, *Mann.*

105. L. STACHYURUS, *Reichb. fil. in Flora*, 1872, p. 274.

Pseudobulbi ligulati (ancipites?) diphylli; folia cuneata oblonga ligulata acuminata; pedunculus subæqualis densiflorus; bracteæ setaceæ ovariis pedicellatis subæquales; sepala ligulata obtusa; petala linearia; labellum trifidum, laciniis lateralibus basi semicordatis; antice obtusangulis, lacinia media triangula; columna apice dilatata; anthera acuta.

Assam, *Mann.*

106. L. STRICKLANDINIANA, *Reichb. fil. in Gard. Chron.* 1880, p. 232.

Pseudobulbi ovoidei conici 1–3-phylli, vulgo 2-phylli; folia lineari-ligulata acuta; pedunculus compressus utrinque alatus hinc ensiformis; racemus pluriflorus densiusculus, bracteæ triangulæ ovariis pedicellatis non æquales; sepala ligulata; petala linearia apice retusa; labellum a cuneata basi transverso dilatatum trilobum, lobis lateralibus rotundatis, lobo medio triangulo brevi, omnibus lobes antice minutissime denticulatis; columna curvata antice vix conspicue dilatata; calli minuti in basin labelli?

Locus ignotus, introd., *Mann.*

107. L. TRILOBA, n. sp.—Pseudobulbus deest; folium singulum (an semper?) lanceolatum acutum recurvum scapum superans, 6 uncias longum, $\frac{3}{4}$ latum; scapus omnino racemosus triuncialis; flores copiosi iis *L. pusillæ* æquales; bracteæ lanceolatæ longæ acuminatæ dimidio ovarii longiores; sepala lanceolata subacuta, lateralia recta; petala linearia ligulata angustiora; labellum trilobum, lobis lateralibus erectis obtusis, medio longiore porrecto ovato-lanceolato obtuso; columna ferme horizontalis arcuata; alis brevibus obtusis.

Philippines, *Cuming! in herb. Lindl.*

Affinis *L. pusillæ*, sed major, et labello trilobo distincta.

108. L. DENDROCHILUM, *Reichb. fil. in Flora*, 1872, p. 278.

Pseudobulbi oblongi apice attenuati approximati diphylli;

folia angusta cuneata oblonga lanceolata acuta; bracteæ lanceolatæ acuminatæ inferiores floribus æquantes, superiores breviores; sepala oblonga acuta, petala linearia acuta; labellum columna bene longius ecallosum oblongum versus apicem obtuse trilobum, lobus medius angustior, nunc obtuse tridentatus; columna apice ampliata; flores straminei labello aurantiaco.

Cult. in horto Dayano.

109. L. PARVIFLORA, *Lindl. Orch. Pl.* p. 31.—Malaxis parviflora, *Blume, Bijdr.* p. 292.—Elasmium parviflorum, *Blume, MSS. in Herb. Brit. Mus.*—L. condylobulbona, *Reichb. fil. in Hamb. Gartenz.* 1862, p. 34.

Pseudobulbi elongati cylindrici 3-unciales; folia bina lanceolata obtusa multinervia, 10 uncias longa, $\frac{3}{4}$ unciam lata; scapus longissimus gracilis, 19-uncialis subangulatus, majore parte racemosus; flores minuti copiosissimi; bracteæ lanceolatæ acuminatæ $\frac{2}{3}$ pedunculi æquales, $1\frac{1}{2}$ lineam longa; sepalum posticum lanceolatum ligulatum obtusum lateralia subsimilia pendula subfalcata; petala anguste linearia; labellum trilobum, lobis lateralibus erectis obtusis, medio bilobo angusto lobis acutis forcipatis brevibus ciliatis; columna arcuata gracilis; anthera hemisphærica subacuta.

Java, *Forbes*! *Blume*! Moulmein, *Parish*!

Descriptio pessima Blumei *Malaxidis parvifloræ* cum *Elasmio parvifloro*, Blume! haud male convenit: cl. Lindleyus plantam non vidit.

110. L. FLACCIDA, *Reichb. fil. in Linnæa*, xli. p. 44.

Pseudobulbus cylindricus, 3–$3\frac{1}{2}$ uncias longus; folia 1–2 angusta lanceolata acuta costata, 7–9 uncias longa, $1\frac{1}{4}$ lata; scapus gracilis pedalis; racemus subdensus elongatus; flores minuti copiosissimi; bracteæ lanceolatæ acuminatæ membranaceæ 1 lineam longæ; sepala ovata lanceolata obtusa, petala linearia angustiora; labellum angustum oblongum ellipticum bilobum, marginibus minute ciliatis, lamina abrupte deflexa; columna gracilis curva, alis brevibus obtusis; anthera ovata obtusa.

Java, *Lobb* 171! Mt. Harrang, *Horsfield*!

Forsan præcedenti nimis affinis, sed validior, et lobi parvi laterales labelli hujus absunt.

Species dubiæ hujus sectionis.

L. PALLIDA, *Lindl. Orch. Pl.* p. 31.—Malaxis pallida, *Blume, Bijdr.* p. 391.

"Foliis in bulbo oblongo compressiusculo vaginato solitariis lanceolatis; bracteis lineari-lanceolatis remotis labelli limbo rotundato retuso crenulato; flores olivacei." Java, Mt. Salak.

L. AFFINIS, *Lindl. Orch. Pl.* p. 31.—Malaxis affinis, *Blume, Bijdr.* p. 392, t. 54.

"Foliis in bulbo ovato oblongo solitariis, lanceolata linearibus inferne canaliculatis, pedunculo nutante, foliorum longitudine; bracteis subulatis, labelli limbo rotundato." Java, Bantam.

L. MINIMA, *Lindl. Orch. Pl.* p. 32.—Malaxis minima, *Blume, Bijdr.* p. 391.

"Foliis in bulbis (seriatis ovatis compressiusculis) lineari-lanceolatis, pedunculo folium æquante compresso, floribus laxe spicatis distichis; capsulis triquetris." Affinis *L. cæspitosæ*. Java: Mt. Salak and Pantjar.

Excluded species.

L. alata, A. Rich. Orch. Nilgh. p. 13, videtur *Microstylis*.

L. Bernaysii, F. Muell. Fragm. Fl. Austral. xi. p. 21, est *Microstylis Bernaysii*, ejusd.

L. bidentata, Griffith, Notul. iii. p. 277, figs. cclxxxviii., planta omnino dubia sed certe non *Liparis*.

L. bracteosa, Lindl. in Wall. Catalogue, no. 7406, est *Platyclinis* sp.

L. densiflora, A. Rich. Orch. Nilgh. p. 14, est *Microstylis*.

L. intermedia, A. Rich. Orch. Nilgh. p. 13, videtur *Microstylis*.

L. priochilus, Lodd. Bot. Cab. 1751, est *Microstylis versicolor*.

L. prionotes, Lindl. MSS. in Herb., est *Sarcochilus* sp.

L. serræformis, Lindl. Orch. Pl. p. 53; Wall. Cat. no. 1946, est *Sarcochilus*, sp.

L. labiata, Sprengel, Syst. iii. p. 741=*Epidendrum labiatum*, Sw.

L. monophylla, Sprengel, *l. c.*=*Epidendrum* ? *monophyllum*, Hook.

Nomina nuda.

L. cylindrostachya, Lindl. ex Hemsley, in Gard. Chron. n. s. xvi. (1881) p. 592. Brasilia.

L. anceps, Lodd. Orchids cult. at Hackney, p. 4. India.

L. elegantissima, Veitch, Catalogue of Garden Plants for 1881.

L. obcordata, "Vahl," Atkinson, Plants of N.W. India, p. 318.

L. tristis, Lodd. Orchids cult. at Hackney, p. 4. Ceylon.

L. "*zeylanica*," Lodd. Orchids cult. at Hackney, ? n. 79, p. 4. Ceylon.

The Mosses and Hepaticæ collected in Central Africa by the late Right Rev. James Hannington, Bishop of Mombasa, F.L.S., F.G.S., &c., with some others, including those gathered by Mr. H. H. Johnston on Kilimanjaro. By WILLIAM MITTEN, A.L.S.

[Read 3rd June, 1886.]

(PLATES XV.-XIX.)

DURING his first journey from the coast opposite Zanzibar to the Lakes, the Bishop, then known as the Rev. James Hannington, collected many very small specimens, chiefly on the Usagara Mountains and in the forest of Ugogo; many of these were entirely barren, and have not yet been identified with any described African species; and they seem to indicate a region not abounding in Mosses or Hepaticæ. In the Usagara the conditions must have been more favourable, for he sent thence by letter many Ferns; but at the time he despatched these his health had been so broken down with the hardships and privations of the journey through a country so deficient in food and water, that he had quite given up all hope of being able to return to the coast. This, however, he eventually did; and during the voyage home, and more rapidly after, regained his usual health.

Induced to return as Bishop of Eastern Equatorial Africa, with residence at Mombasa, the importance of finding a better rout to the Missionary station in Uganda must have seemed to him, who had experienced the miseries of the older road, a matter of urgency. Being a man possessed of great courage and the faculty of winning others to do as he wished, he soon made an attempt to ascend Kilimanjaro. On his return from this expedition he wrote from Mombasa (May 13, 1885):—" I only got up to about 8800 feet; I wanted to get to the snow-line, and made a desperate struggle, but the ascent is so gradual, that it takes such a dreadfully long time. I started from about 5000 feet, and walked from morning till 4 P.M. with scarce any stoppages, and then never got out of the dense forest-tangle. The same Mosses seem to me to crop up here as in Usagara; my plants all got spoilt with the intense rain, the Mosses running a very narrow shave, and many are discoloured. The rainfall has been very ter-

rible, 6 inches in four days; so that I am expecting an unhealthy time shortly. This new road is perfectly healthy; I think the dangers have been greatly exaggerated. The road being healthy, one can endure much vexation and delay; travelling has been as though I was in England or Wales."

On another slip of paper he goes on:—"I found three or four brambles on Kilimanjaro, also *Sibthorpia* and *Arthrolobium*. I found also another *Hydnora*; and have determined in my own mind beyond any question that there are two species—growth, habit, size, substance, colour, shape entirely different; what more can you want to make a species?" This refers to doubts expressed when he brought home from his first journey a painting of a species he had met with.

In the interval between the Bishop's two expeditions a box was sent from the Usagara by Mr. Last, containing sundry objects of natural history, a variety of living plants and ferns packed in lichens, chiefly *Parmelia perforata*, amongst which were a few additional Mosses. The living plants were *Dorstenia indica*; a tetraquetrous *Euphorbia*? with mottled green and white stems and oblanceolate foliage; also *Asplenium trifidum*. With these were dead Orchids and Ferns; some of the latter being planted, gave rise to *Streptocarpus caulescens* and *S. Kirkii*, as well as *Impatiens Sultani*; these were supposed to have come from an altitude of about 4000 feet.

All the species in the following enumeration, unless otherwise stated, were collected by the Bishop himself.

ARCHIDIUM, *Brid.*

A. AFRICANUM, sp. n. (Pl. XV. figs. 1–4.) Monoicum; folia caulina patentia lanceolata integerrima, nervo continuo, cellulis oblongis, perichætialia subduplo longiora latioraque, apice subulato acuminata, thecam globosam obtegentia; sporis obtuse angulatis rotundatis (17); flore masculo gemmiformi.

Hab. Usagara Mountains.

Similar to the European *A. alternifolium*, and differing in habit and also in the oblong not abbreviated cells of its leaves from the African *A. Ecklonii*; the subulate part of the perichætial leaves is about one third of their whole length; the same portion of the leaves in *A. Ecklonii* occupies two thirds.

It appears probable that the species of this genus will become

numerous; for besides the two African species above named, another was collected by Dr. Rehmann near Cape Town:—

A. REHMANNI, sp. n. (Pl. XV. figs. 5–8.) Monoicum, pulvinatum cæspitosum; folia patentia deltoideo-ovata, nervo percursa, e cellulis breviter oblongis areolata, perichætialia e basi orbiculari convoluta in subulam angustam producta patula; theca globosa; sporis lævibus (12); flore masculo gemmiformi stipitato.

Stature that of *A. alternifolium*; stems short, with many short branches.

All these African species agree generally with the oldest known European species, and very similar ones are found in India and Australia; but a great departure is presented by a species sent from Monte Video by M. Gibert, No. 1249.

A. GIBERTI, sp. n. Monoicum; caules erecti in cæspites compactos aggregati graciles humiles; folia subjulacea imbricata erectiuscula subdeltoideo-ovata brevissime acuminata integerrima, nervo angusto percursa, cellulis minutis rotundis ubique areolata, perichætialia late ovata brevi apiculata convolutacea; theca globosa tenera; sporis magnis sublævibus; flore masculo gemmiformi in apicibus ramorum. Caulis circiter centimetrum altus cum foliis 0·25 mm. latus. Folia juniora subglauco-viridia, seniora pallide fusca.

This, in its julaceous stems, is analogous to those species of *Pleuridium* like the Australian *P. tenuissimum*.

TREMATODON, *Rich.*

T. LIGULATUS, *Rehmann*, 22.
Hab. Usagara Mountains.

DICRANUM, *Hedw.*

D. (§ HEMICAMPYLUS) DICHOTOMUM, *Brid.*
Hab. Kilimanjaro.

Originally described from Bourbon specimens: it is found also in Madagascar.

D. (§ EUDICRANUM) JOHNSTONI, sp. n. Caulis pallide fusco tomentosus; folia laxa patula apicalia falcata secunda linearia sensim loriformi-angustata, nervo dorso bicarinato infra summum apicem latiusculum desinente marginibusque e medio ad apicem

breviter denticulatis, cellulis angustis inferioribus parietibus continuis alaribus externis obscuris internis hyalinis.

Hab. Kilimanjaro, 10,000 feet. "A fragment (a single stem) of a large piece of moss; the rest accidentally lost."—*H. H. Johnston*, No. 52.

Somewhat similar to a slender state of *D. majus*; unlike any state of *D. Scoparium*, from the narrower lower portions of the leaf.

LEPTODONTIUM, *Hampe*.

L. RADICOSUM, *Mitt.*—Didymodon, *Mitt. Journ. Linn. Soc.* vii. p. 149.

Hab. Kilimanjaro, *Bishop Hannington*. Usagara Mountains, *Mr. Last*.

Rather smaller in all its parts than the specimens from the Cameroon Mountains; and it seems but little different from the Indian *L. squarrosum.*

The Usagara specimens are the most slender and elongated; but in none is the form of the leaves so much narrowed upwards as in *L. stellatum.*

L. TRISTICHUS.—Zygodon, *C. Müll. Bot. Zeit.* 1855, p. 764.—Z. strictissimus, *Rehm.* Seems identical with *Z. Priessianus*, Hampe, Linn. 1860, p. 683=*Didymodon papillatus*, Hook. f. et Wils., *Leskia rubricaulis*, Taylor. If there proves no distinction in the fruit, the species ranges from S. Africa to Abyssinia, Australia, and New Zealand.

CAMPYLOPUS, *Brid.*

C. PERPUSILLUS, sp. n. (Pl. XV. figs. 9–12.) Gracilis laxe cæspitosus; folia erecto-patentia elongate oblongo-lanceolata, apicem versus abrupte acuminata caviuscula, nervo excurrente apice pauce dentato, cellulis superioribus ovali-rotundis inferioribus oblongis rectangulatis, perichætialia vix diversa; theca minuta ovalis in pedunculo flexo pendula sepulta, operculo conico acuminato, calyptra brevis basi fimbriata, peristomio dentibus teneris incompletis.

Hab. Ugogo.

In appearance this small species is more like the young states of *Anisothecium varium* than of any species of *Campylopus.* The plants are buried in sandy earth to near their apices; and the fruit is quite invisible until sought for.

Fragmentary specimens of several other species of this genus were collected during the first journey, but all too small in quantity to determine.

Oncophorus, *Brid.*

O. (§ Rhabdoweisia) cyathicarpus (Zygodon, *Mont.*).

Hab. Kilimanjaro, *Mr. H. H. Johnston*, No. 12, with fruit. Under 8000 feet without fruit, *Bishop Hannington.*

This Moss appears to inhabit the whole of Africa where there are suitable mountain-regions.

Schistomitrium, *Dozy et Molk.*

S. acutifolium, sp. n. Cæspitosum, humile densifolium; folia patentia recta secundave a basi ovali concava, lamina utraque e cellulis tribus lata inde marginibus incurvis subulato canaliculato, apice excavata mucrone parvo angusto terminata lævia integerrima, perichætialia caulinis longiora subulata obscuriora.

Hab. Usagara Mountains, *Bishop Hannington and Mr. Last.* Natal, *Mrs. Saunders.* Madagascar, *Dr. Meller.*

Caulis 1 cm. altus, cum foliis vix 3 mm. latus. Folia superiora glauco-viridia, inferiora albescentia, 2 mm. longa.

Similar to *S. cucullatum*, Thw. et Mitt., but with more subulate contracted leaves.

All the species yet known to belong to this genus agree very closely in the form of their leaves and in their having a mucronate point. *S. apiculatum* and *S. robustum* have been figured with fructification, which is absent in *S. cucullatum* and in *S. acutifolium*, although in the last perichætia at the apices of some of the stems are present. The genus, so far as known, seems restricted to the Indian Archipelago, Ceylon, and Tropical Africa, and, beside those mentioned, must include another gathered on Kina Balu by Mr. Low:—

S. Lowii, sp. n. Folia secunda falcatave dense inserta oblongo-lanceolata concava inferne limbo e seriebus cellularum oblongarum 4-marginata inde marginibus incurvis canaliculata, apice abrupte excavato, apiculo parvo terminata lævia perichætialia vix diversa; theca in pedunculo gracili aurantiaco lævi cylindracea, calyptra basi fimbriis divergentibus.

This is a little less than *S. robustum*, and thus much larger than *S. apiculatum* or *S. acutifolium.*

GRIMMIA, *Ehrh.*

G. LEUCOPHÆA, *Grev.*

Hab. Kilimanjaro, covering stones at 12,000 feet, *H. H. Johnston.*

SYRRHOPODON, *Schwægr.*

S (§ORTHOTHECA) ASPER, sp. n. Cæspitosus; caulis curvatus; folia sordide viridia dein pallescentia, siccitate secunda curvata, humida patentia, a basi oblonga latiora hyalina, margine superne dentato, subulato angustata longe linearia, apice acuta, margine limbo calloso densissime papilloso duplicato dentato, nervo dorso papilloso asperrimo, cellulis densis obscuris areolata.

Hab. Usagara Mountains and Kilimanjaro, *Bishop Hannington.*

Similar to *S. circinatus*, but with narrower leaves, the base entirely occupied with hyaline cells.

Caulis 2–4 cm. altus; folia 5 mm. longa.

Fragments of a species of *Eusyrrhopodon*, like *S. Gaudichaudi*, were also amongst the Mosses from Kilimanjaro.

THYRIDIUM, *Mitt.*

T. AFRICANUM, sp. n. Caulis decumbens; folia humida erecto-patentia sicca appressa apicibus incurvis oblongo-lanceolata acuta supra basin parum latiora, nervo percursa, margine flexuoso anguste hyalino limbata remote brevissime serrulata, cellulis minutis rotundis obscuriusculis basalibus mediis oblongis hyalinis ad tertiam partem, folii longitudinis juxta nervum protractis areolata.

Hab. Usagara Mountains, *Mr. Last.*

Caulis subuncialis. Folia 4 mm. longa, 1 mm. lata, sordide viridia, juniora pallidiora sub glauco-viridia.

A very distinct species of which the specimens are too incomplete; it appears to be a little more robust than *T. fasciculatum.*

CALYMPERES, *Sw.*

C. LIGULARE, sp. n. Humile; folia patentia ligulata inferne haud dilatata, apice plus minusve acuta, nervo longiore producto mucronata, margine integerrima limbo nullo, cellulis hyalinis spatium breve subquadratum occupantibus reliquis minutis rotundis viridibus; fructus *C. Afzelii.*

Hab. Usagara Mountains, *Bishop Hannington.*

Statura adspectuque omnino *C. Afzelii*; folia longitudine latitudinem quinquies superant.

In its leaves having no limb this species is distinct from the other African species, and comes nearer to the wide-spread *C. Dozyanum* of the Indian Archipelago and Pacific Islands.

SYSTEGIUM, *Bruch et Schimp.*

S. UNGUICULATUM, sp. n. Caulis brevis simplex ramosusve; folia in comam disposita patentia sicca incurvata crispata elongate lanceolata, perichætialia paululum latiora omnia canaliculata marginibus superioribus involutis, nervo latiusculo in mucronem unguicularem excurrente, cellulis minutis rotundis inferioribus oblongis; theca parva immersa ovali-globosa, calyptra stylo elongato.

Hab. Qua Chiropa.

Caules in cæspitibus laxis aggregati 1·50 mm. alti. Folia longiora 2 mm. longa luteo-viridia, nervo pallidiore; theca pallide aurantiaca, 0·25 mm. longa.

Smaller than the European *S. crispum,* but corresponding generally with it; and nearly similar species seem to be found in India and S. America.

HYOPHILA, *C. Müll.*

H. PLICATA, sp. n. (Pl. XV. figs. 13–16.) Monoica, gregarie cæspitosa humilis; caulis inferne foliis parvis sparsis apice rosulatim foliatus; folia patula obovata spathulata obtusissima integerrima, nervo ad apicem percurrente lævi, cellulis superioribus parvis rotundatis basalibus majoribus quadratis pallidioribus, perichætialia ovali-oblonga obtusa; theca in pedunculo gracili pallido erecta elongate ovali-cylindracea acute octangulata, operculo conico acuminato recto, peristomio brevi dentibus subulatis solidis rubris lævibus infra os insertis 16 annulo composito; flos masculus fœmineo similis.

Hab. Usagara Mountains, on the ground.

In its manner of growth and foliage this resembles many species of Mosses referred to *Hyophila,* such as *H. javanica* and *H. involuta*; but the plicate capsule is peculiar, and the peristome is rather that of a *Weisia* than of an incomplete *Tortula.*

Anœctangium, *Hedw.*

A. pusillum, sp. n. (Pl. XV. figs. 17–19.) Humile; folia patentia incurva sicca contorta ligulata obtuse acuta, nervo valido pallido dorso lævi sub summo apice desinente carinata, margine subintegerrima, cellulis densis obscuris basalibus paucis mediis suboblongis pellucidis; theca in pedunculo gracillimo pallido ovata.

Hab. Kilimanjaro, *Bishop Hannington.*

Folia juniora æruginoso viridia, seniora fuscescentia in verticillis interruptis disposita.

A small species, which agrees very nearly with *A. Mariei*, Besch., from Nossi-bé; but the apices of the leaves are wider and their nerve is not papillose. Among the small specimens gathered there is no indication of the stems being tomentose with rootlets.

Macromitrium, *Brid.*

M. (§ Macrocoma) Dregei, *Hornsch. Linn.* xv. p. 131.

Hab. Usagara, *Bishop Hannington and Mr. Last.*

The difficulty in extricating the species of this group without examination of the original specimens has led to some confusion, and the following appears to have been mistaken:—M. confusum, sp. n. Dioicum; *M. Lycopodioidi* simillimum sed robustior, foliis e cellulis distinctis areolatis.—*M. Lycopodioides*, C. Müll., Rehm. 165 *b*, 166; *M. tenue*, var. *brachypus*, ejusd. 162; *M. cæspitans*, C. Müll. (planta mascula), Rehm. 159.

Gathered on Table Mountain by most collectors, and in Natal by Capt. Rooper.

Always a little larger than the true *M. Lycopodioides* gathered by Dr. Burchell and also by Dr. Rehmann (*M. Dawsoniomitrium*, C. Müll., Rehm. 160).

Zygodon, *Hook. et Tayl.*

Z. (§ Stenomitrium) erosum, sp. n. Habitus staturaque *Z. trichomitrii*, sed foliis angustioribus apice apiculo parvo pellucidiore acuto marginibus minutissime crenulatis, cellulis basi pro spatio quadrato elongatis pellucidis reliquis minutis parietibus latis pellucidioribus.

Hab. Kilimanjaro, a few barren stems, *Bishop Hannington.*

With the same appearance as *Z. trichomitrius*, Hook. et

Wils. (*Z. runcinatus*, C. Müll.), *Z. Rehmanni*, C. Müll., and *Z. rugifolius*, ejusd., all gathered in S. Africa by Dr. Rehmann; and agreeing very nearly with the S.-American *Z. pentastichus*, *Z. quitensis*, and *Z. crenulatus*, Musc. Aust.-Amer. The *Anacalypta stellatifolia*, Hampe, probably belongs to the same group. The fruit is seldom in a state to afford a correct idea of the structure of the internal peristome; but it is impossible to avoid the considerations arising from an examination of the S.-American species without recalling the remarks upon them by Wilson, Bry. Brit. 264, in his notes on *Paludella*; and the more natural arrangement may be to bring together *Zygodon*, *Paludella*, and *Aulacomnion*, at least so far as relates to the bog species, if indeed these two latter genera are truly more than steps higher in peristomial development in a natural genus containing such great diversity in that appendage as is observable in undoubted *Zygodons*.

Bryum, *Linn.*

B. (§ Brachymenium) pulchrum, *Hook. Bot. Miscell.* 1830, t. 38.

Hab. Usagara Mountains, forming large patches and in fruit, *Bishop Hannington*.

B. (Brachymenium) capitulatum, sp. n. Monoicum; caulis humilis inferne radicellis fuscis foliisque sparsis parvis obtectus superne subrosulatim foliatus innovationibus conformibus infra perichætium oriundis flore parvo masculo terminatis; folia obovato-spathulata, nervo in setam rectam excurrente apiculata, margine limbo e duplici seriebus cellularum versus apicem indistincto pauci serrulato inferne recurvo, cellulis reliquis breviter ovalibus areolata, perichætialia lanceolata angustiora; theca erecta inclinataque oblongo-obovata clavæformis, operculo satis parvo breviter conico peristomii dentibus a basi sensim angustatis interni membrana usque ad medium dentium producta.

Hab. Kilimanjaro, *Bishop Hannington*; he gathered it also in the Usagara Mountains. Cameroon Mountains, *Mann*; Central Madagascar, *G. W. Parker*.

Entirely similar to *B.* (§ *Brachymenium) nipalense* in habit but rather smaller in stature. It differs from *B. flexifolium*, from Abyssinia, in its more strongly nerved and firmer leaves as well as in the more regularly erect capsules. The form of the operculum

seems to vary with the age of the capsule; from conic it becomes in age hemispherical.

B. (§ EUBRYUM) ROSEUM, *Schreb.*

Hab. Kilimanjaro, with perfected fruit, *Bishop Hannington*; Usagara Mountains, barren, *Mr. Last.*

B. integrifolium, Rehm., from Natal, appears to be not different, the foliage being dentate, as usual in European specimens of *B. roseum.* It was gathered also in Sierra Leone by Barter and in Madagascar by Dr. Meller; and it is most probable that the Indian *B. giganteum*, Hook., and the S.-American *B. grandifolium*, Tayl., are but states induced by some different conditions of one widely spread species.

B. COMMERSONII, *Schw.*

Hab. Kilimanjaro, barren.

From this *B. umbraculum*, Burchell, differs scarcely at all. In some state the species appears spread over the Southern hemisphere.

B. ALPINUM, *Linn.*

Hab. Usagara Mountains, barren, *Bishop Hannington.*

Of the usual colour and appearance; this handsome species is found in the Cameroon Mountains and in S. Africa.

B. ARGENTEUM, *Linn.*, var. ARGYROTRICHUM.—B. (§ Argyrobryum) argyrotrichum, *C. Müller*, *Linn.* 1875, p. 385.

Hab. Usagara Mountains, *Bishop Hannington.*

At first sight this differs greatly from the common states of the species as seen in Europe, but the differences seem completely connected by specimens from the Nilgiri Mountains, and in one from Abyssinia both states of the foliage are observable on the same specimen.

B. CORONATUM, *Schw.*

Hab. Usagara Mountains.

MNIUM, *Linn.*

M. ROSTRATUM, *Schrad.*

Hab. Kilimanjaro, without fruit, *Bishop Hannington.*

Inflorescence as usual and not in any way differing from European states.

RHIZOGONIUM, *Brid.*

R. (§ PYRRHOBRYUM) SPINIFORME, *Linn.*
Hab. Kilimanjaro, *Bishop Hannington.*

HYPOPTERYGIUM, *Brid.*

H. LARICINUM, *Brid.*
Hab. Usagara Mountains; also gathered by Mr. Last.

RHACOPILUM, *Brid.*

R. AFRICANUM, *Mitt. in Journ. Linn. Soc.* vii. p. 162.
Hab. Msilala, and on Kilimanjaro, *Bishop Hannington.*

Specimens to all appearance the same come from Mauritius and Madagascar; but as none have been seen in fruit except those from the Cameroons it cannot be decided. The Abyssinian *R. longe-aristatum*, C. Müll., does not appear to differ; *R. capense*, C. Müll., Rehmann 267, seems to be *R. mucronatum*, Beauv., it is found in Natal. Besides these there have been described *R. angusti-stipulaceum*, C. Müll., from Comoro; *R. speluncæ*, ejusd., from Kalunga, Bongo; *R. pectinatum*, ejusd., from Dar Fertit, with the preceding collected by Dr. Schweinfurth; there is also the *R. mauritianum*, C. Müll., *R. angustifolium*, and *R. prælongum*, Schimp., enumerated by Bescherelle from Bourbon, Mauritius, and Comoro. A well-marked species was sent by Dr. Ayres from Mauritius:—

R. AYRESII, sp. n. Caulis pinnatim ramosus sed sæpius longe procerus parce tomentosus; folia inter se remota pectinatim distichacea ovali acuminata, nervo obscuriore in aristam dimidiam folii longitudinis æqualem excurrente lævi, margine apicem versus subintegerrima, in ramis denticulata, cellulis omnibus mollibus ovalibus pellucidis areolatis; folia stipuliformia ovata, nervo in subulam æquilongam lævem excurrente.

Hab. The Pouce Mountain.

Dr. Ayres himself noticed that this differed from the other species he had gathered (*R. africanum*) in being without the tomentum. In its areolation it is quite distinct, but it may be really one of the species before mentioned as already described, in which the form of the cells is not stated.

The description of the areolation of *R. prælongum* given by M. Bescherelle in his 'Florule de la Réunion,' &c., corresponds very nearly with that found in *R. africanum*.

HOOKERIA, *Sm.*

H. (§ CALLICOSTA) VERSICOLOR, *Mitt.*—Lepidopilum, *Mitt. Journ. Linn. Soc.* vii. p. 159.

Hab. Kilimanjaro, *Bishop Hannington.*

This closely agrees with the S.-American *H. Langsdorfii* and the Indian *H. Utacamundiana* as well as the Javan *H. macropus.* Great difficulty arises in the comparison of specimens of the species of this group from the uncertain manner of their revival by maceration in water after having been dried; in some the cells refuse to expand at all, and thus the areolation may appear completely different from what it was in the living moss.

The *Hookeria* (§ *Lepidopilum*) *angolensis*, Duby, Mém. de la Soc. de Phys. de Genève, tom. xxi. (1872), seems to be the same species, which differs from *H. Pappeana*, Hampe, Ic. 11, in its undulated and shining leaves when dry and its more narrow areolation. Fragments which appear to belong to *H. Pappeana* were amongst Mosses collected in the Usagara.

LEPIDOPILUM, *Brid.*

L. HANNINGTONI, sp. n. Monoicum; caulis subsimplex; folia distichacea media intermediaque ovato-oblonga lateralia patentia longiora omnia subulato acuminata, margine superne serrulata, limbo nullo, cellulis elongate oblongis nervis binis medio evanidis, perichætialia parva ovato-lanceolata; theca in pedunclo brevi fere lævi ovalis, peristomii dentibus lamina externa rubra supra totam latitudinem laminæ internæ hyalinæ protracta, processus æquilongis in membrana brevi exserta insidentibus; calyptra parva sublævis.

Hab. Usagara Mountains, *Bishop Hannington.*

Caulis unciam altus cum foliis explanatis 3 mm. latus. Folia subnitida, stramineo-viridia plus minus rubescentia.

L. LASTII, sp. n. Monoicum; caulis subsimplex; folia distichacea compressa media intermediaque ovalia lateralia longiora oblonga omnia apice subacuminata acuta marginibus versus apicem serrulatis, limbo nullo, cellulis oblongo-elongatis, nervis brevibus, perichætialia parva late ovata acuminata; theca in pedunculo brevi setulis densis obtecto ovalis erecta papuloso aspera operculo acuminato, peristomii dentes elongati, lamina externa rubra angusto $\frac{1}{3}$ tantum latitudinis laminæ internæ tegens,

processus perist. intern. æquilongis in membrana brevi impositis minute punctulatis; calyptra ramentis brevibus inspersa.

Hab. Usagara Mountains., on small branches, *Mr. Last.*

Caulis unciam altus cum foliis 3–4 mm. latus. Folia stramineo-viridia vix nitentia. Pedunculus 3–4 mm. longus. Theca 1 mm.

Closely resembling *L. Hanningtoni*, but very different in its fruit.

DALTONIA, *Hook. et Tayl.*

D. PATULA, *Mitt. in Journ. Linn. Soc.* vii. p. 162.

Hab. Usagara Mountains, *Mr. Last*; Kilimanjaro, *Bishop Hannington.*

The Kilimanjaro specimens are a little more robust than those from the Cameroons and Usagara; but too little has been seen to be certain that they belong to one species.

HEDWIGIA, *Ehrh.*

H. (§ BRAUNIA) SECUNDA, *Hook. Musc. Exot.* t. 99.

Hab. Kilimanjaro, perfectly fruited, *Bishop Hannington.*

In size, colour, ramification, and foliage the specimens agree so closely with Mexican, that it is impossible to avoid the conclusion that they belong to the same species; and the question at once arises are the *Braunia sciuroides* of S. Europe, the *B. indica,* so luxuriant in the Nilgiri Mountains, and the Abyssinian *B. Schimperi* really different, or are they not rather most probably slight variations of one wide-spread species?

H. (§ EUHEDWIGIA) CILIATA, *Ehrh.*

Hab. Kilimanjaro, *Bishop Hannington.* In no way different from European specimens.

CRYPHÆA, *Brid.*

C. (§ EUCRYPHÆA) LAXIFOLIA, sp. n. Monoica; rami elongati, ramulis paucis remotis elongatis vix pinnatim ramosi; folia patentia sicca appressa laxa ovato-lanceolata, apice latiuscula submucronata breviterve apiculata ibique subserrulata, margine inferiore recurva, nervo infra apicem evanido carinata e cellulis parvis rotundatis areolata, perichætialia lateralia patentia anguste cylindracea; foliis internis thecam ovali-cylindraceam totam

vaginantibus inde abrupte in mucronem aristiformen patentem productis.

Hab. Usagara Mountains, *Mr. Last.*

Another closely allied species is C. DENTATA, sp. n. Rami stricti curvative, ramulis sparsis pinnatim ramosi interdum subsimplici; folia imbricata ovata latiuscule acuminata, apice dentata, margine anguste recurva, nervo sub apice desinente, perichætialia lateralia parva; foliis internis erectis spathulatis, apice paucidentatis, nervo inferne evanescente in mucronem setaceum erecto patentem excurrente; theca immersa ovali-cylindracea, operculo brevi conico acuminato, peristomio interno externum breviore.

Hab. Umgoe Mountains, Natal, *Mr. Plant*; gathered also by Mr. Keit, No. 3.

Both these African species agree generally with the Mexican *C. patens*, Hsch., but are more slender; they have no near resemblance to the Indian *C. sphærocarpa.* In the dried state the two species are not very dissimilar; but on wetting them a great difference is observable in the loose spreading foliage of *C. laxifolia.*

C. (§ ACROCRYPHÆA) WELWITSCHII, *Duby*, *Mém. de la Soc. de Phys. de Genève*, tom. xxi. p. 426, t. 2. f. 1.

Hab. Usagara Mountains, and on Kilimanjaro, *Bishop Hannington.* It is found also in Madagascar.

The specimens yet seen of this species, if indeed they all belong to one, are in too small quantity to afford sufficient means of comparison; similar forms are found in India (*C. concavifolia* and *C. incurvifolia*), and in S. America several others. All agree in their mode of fructification, and differ chiefly in their leaves; and it may reasonably be doubted if in reality they are all distinct, or states of one or two species of which *C. julacea*, Hornsch., from Brazil, was the earliest known. It is not an easy matter to find in some of the specimens what may truly be a cauline leaf on stems which are merely fertile branches.

PRIONODON, *C. Müll.*

P. REHMANNI, sp. n. Folia subcompressa patula inferne ovali-lanceolata anguste ligulato attenuata acuta (sæpissime diffracta), nervo sub apice desinente, margine late implana, superne

dentibus brevibus divergentibus armata, inferne ut plurimum bisulcata e cellulis minutis areolata punctulis asperula.

Hab. Kilimanjaro, *Bishop Hannington.* Transvaal, *Dr. Rehmann.* Also in Mauritius?

Very nearly resembling *P. densus*, C. Müll. (*Hypnum*, Sw.), from Jamaica, Mexico, and Tropical America—regions in which that species is now known to be accompanied by many others, but until the discovery of the African species none was known to have been found elsewhere.

Pterobryum, *Hornsch.*

P. flagelliferum, sp. n. (Pl. XVI. figs. 1–3.) Rami inferne breviter stipitati flexuosi, ramulis variis pinnati flagellis minute foliatis gracilibus; folia patentia ovato-lanceolata, nervo infra apicem planum desinente caviuscula integerrima, cellulis elongatis, perichætialia anguste oblongo-lanceolata sensim angustata supra medium nervata, theca ovato-oblonga operculo convexo brevi acuminato, duplo longiora, integerrima.

Hab. Usagara Mountains, *Mr. Last.*

P. Hanningtoni, sp. n. (Pl. XV. figs. 20–22.) Rami a caule primario rhizomæformi ascendentes subplumæformes, curvuli; ramulis plurimis patentibus distichis fere ad basin usque pinnatis; folia patentia laxe imbricata ovato-lanceolata parum acuminata concava sicca subplicata, nervo infra apicem planum desinente integerrima e cellulis elongatis areolata, perichætialia oblongo-lanceolata subulato attenuata ad $\frac{3}{4}$ usque nervata, thecam oblongam $\frac{1}{3}$ superantes.

Hab. Usagara Mountains.

Both these species are nearly allied to the South-American *P. trichomanoides*, Spruce, *P. filicinum*, Sw., and *P. angustifolium*, C. Müll.; and although very nearly resembling each other, when once the differences are apprehended are readily separable.

P. Hanningtoni has much more numerous and shorter branchlets and a denser foliage, besides the differences in the perichætium.

Calyptothecium, *Mitt.*

C. africanum (Trachyloma, *Rehm.*).

Hab. Kilimanjaro, *Bishop Hannington.* Usagara Mountains, *Mr. Last*, gathered also by Burchell. All the specimens barren.

So far as known, the greatest number of the species of this group of *Neckera*-like Mosses is found in the Indian Archipelago, Pacific Islands, and Australia; and should some of those as yet known only in a barren state prove to produce an exserted capsule, they would approach very closely to *Trachyloma.* The *Trachyloma stipitatum*, Mitt. in Journ. Linn. Soc. vii. p. 156, is more correctly a species of *Hypnodendron*, very nearly allied to *H. arcuatum* and the other species of the same group as *H. Archeri.* It has the same tree-like mode of growth and the same areolation, the ends of the cells having a callosity which gives the leaves a dotted appearance, but which does not show as prominences when the leaf is folded over. It is the only species which has a nerve not continued to the point of its leaves.

Erpodium, *Brid.*

E. Hanningtoni, sp. n. (Pl. XVI. figs. 4–7.) Monoicum; caulis procumbens, radicellis fuscis repens; ramis fertilibus ascendentibus paucis ramosus; folia caulina patentia laxe sursum imbricata ovalia obtusa caviuscula e cellulis parvis rotundis viridibus in dorso folii papilliformi protuberantibus obscuriusculis limitibus pellucidioribus areolata, apice in pilum æquilongum lævem albidum e cellulis angustis elongatis hyalinis compositum subito producta; folia in ramis fertilibus appresse imbricata inferiora ovata e cellulis rotundatis ovalibusque pellucidis limitibus angustis, perichætialia interna majora sensim in subulam hyalinum angustata, cellulis folii heteromorphis papillis grossioribus asperrima; theca immersa oblonga, operculo convexo apiculato annulo lato, sporis lævibus, calyptra brevis campanulata basi multifida plicata apice subaspera; flos masculus gemmiformis parvus.

Hab. Lake Nyanza, on *Adansonia digitata* (*Bishop Hannington*).

Caulis procumbens uncialis cum foliis 1 mm. latus; ramis fertilibus 2–3 mm. longis. Folia caulina 0·5 mm. lata cum pilo 1·50 mm. longa.

E. Schweinfurthii, C. Müll., Linn. 1875, p. 412, is described with cordate leaves, "acumine a basi latiusculo breviter attenuato," and must therefore be quite different, although in some particulars relating to the fruit it seems to agree pretty nearly; it is also stated to be diœcious. Both species are allied most nearly to the S.-American *E. coronatum*; but still more closely agree with a

remarkable species collected during the visit of the 'Challenger' to Japan, to be more fully described elsewhere.

ERPODIUM JAPONICUM, sp. n. Folia ovata obtusa acuminatave in pilum breviorem pellucidum producta; theca emergens, peristomio e dentibus subulatis 16, calyptra fere ad basin thecæ ovali oblongæ descendens 14–16-plicata.

In this the whole appearance is that of *E. Hanningtoni*, the point of the leaf being shorter; it is less conspicuous, and instead of covering little more than the operculum, the calyptra includes nearly the whole of the capsule; and the presence of a completely developed simple peristome is a new character in the genus.

METEORIUM, *Brid.*

M. (§ EUMETEORIUM) IMBRICATUM, *Beauv. Schw.* t. 165.

Hab. Usagara Mountains and Kilimanjaro, without fruit, *Bishop Hannington.*

Very variable in colour from pale green to orange-brown, also in the form of the leaves of the stems, less so in those of the branches; their arrangement in series is chiefly evident on the secondary ramuli. The species appears spread across Tropical Africa, but not seen from the south.

M. (§ PAPILLARIA) AFRICANUM, *C. Müll.*

Hab. Usagara Mountains, *Mr. Last*; there and also on Kilimanjaro, *Bishop Hannington.*

A wide-spread African moss, of which the fruit is wanting on all our specimens.

TRACHYPUS, *Schw.*

T. SERRULATUS, *Beauv.*

Hab. Kilimanjaro, *Bishop Hannington.*

Originally described from Bourbon, it is now known from Madagascar and also from the Cameroon Mountains. It appears to be always more compressed and less rigid than the nearly allied Indian *T. crispatulus.*

LEPTODON, *Brid.*

L. SMITHII, *Mohr.*

Hab. Kilimanjaro, *Bishop Hannington.* Previously known from S. Africa.

Porotrichum, *Brid.*

P. pennæforme, *C. Müll.*

Hab. Kilimanjaro, *Bishop Hannington.* Found also in S. Africa (*Thamnium complanatum*, Schimp.); also in Madagascar (*P. madagassum*, Kiaer.), and on the Cameroon Mountains, *G. Thomson.* It is very similar to *P. longirostrum.*

P. pterops, *Rehm.*

Hab. Kilimanjaro, *Bishop Hannington.* Natal, *Dr. Rehmann.*

P. usagarum, sp. n. Folia rami primarii rotundo-ovata, apice abrupta, apiculo parvo, nervo valido infra apicem abrupte desinente, ramulina rotundo-oblonga apiculo brevi, omnia margine apicem versus serrulata e cellulis densis ovalibus areolata.

Hab. Usagara Mountains.

Closely resembling the *P. elegans* from Samoa, in size, colour, ramification, and appearance, but distinct in the form of its foliage. It is one of a number of small species which differ more in appearance than in any other particular from those which agree in aspect with *P. longirostrum.*

These constitute the section denominated by C. Müller "*Pinnatella*," and he has described two species collected by Dr. Schweinfurth in Monbuttu, and another from Comoro, *P. Geheebii* (Linn. 1876, p. 272), the description of the leaves of which applies nearly to *P. usagarum*; and this last may be but a more grown-out state which has not subsimple stems sparingly pinnate as stated in the description. Other species are found in Madagascar and Mauritius; all have a general resemblance to *P. elegans*, and agree in the dull, not glossy, foliage and tree-like stems. From the above the group of species designated by C. Müller *Anastrephidium* differ in their stiff and more glossy foliage, and a great tendency of the branches to run out into slender attenuated flagelliform shoots. To this group belong the *P. ramulosum*, Mitt. in Journ. Linn. Soc. vii. p. 160, from the Cameroons, from which it seems difficult to distinguish *P. pennæforme* var. *brachyphyllum*, Rehm. 334, from Inanda, Natal, gathered also in S. Africa by Cooper, and *P. flagellaceum*, Mitt. in Trans. Linn. Soc. xxiii. t. 5, from which the *Homalia elongata*, Duby, Mém. de la Soc. de Phys. de Genève, tom. xxi. t. 2. f. 3, may not be different.

PLAGIOTHECIUM, *Bruch et Schimp.*

P. NITIDIFOLIUM, *Mitt.*

Hab. Kilimanjaro, a few fragments only.

Quite different from *P. membranosulum*, C. Müll., Rehm. 389, and from another species gathered by Dr. Rehmann on Table Mountain.

STEREOPHYLLUM, *Mitt.*

S. RIVULARE, *Mitt. in Trans. Linn. Soc.* xxiii. t. 5. f. 4.

Hab. Msilala.

The *Hypnum andongense*, Welw. et Duby, seems to be the same species.

S. NITENS, *Mitt. l. c.*—Homalia linguæfolia, *Welw. et Duby, Mém. de la Soc. de Phys. de Genève*, tom. xxi. p. 431.

Hab. Usagara Mountains.

So far as can be judged from the description, Duby's species appear to belong as above.

FABRONIA, *Raddi.*

F. SCHIMPERIANA, *Hampe.*

Hab. Usagara Mountains, and on Kilimanjaro, *Bishop Hannington.*

In the specimens collected some of the leaves are slightly serrulate and some almost entire; the length of the leaf-point seems also variable, from one third to half the length of the leaf itself.

MICROTHAMNIUM, *Mitt. Musc. Aust.-Amer.*

M. PSEUDOREPTANS, *Jaeger, Adumb.* ii. p. 494.—Hypnum, *C. Müll. Bot. Zeit.* 1856, p. 439.

Hab. Kilimanjaro, *Bishop Hannington.*

M. fruticellum from the Cameroons is more slender, and may be only a smaller form; but *M. frondosum* from the same place is quite different in its short wide leaves.

PTEROGONIUM, *Sw.*

P. GRACILE, *Sw.*

Hab. Kilimanjaro, *Bishop Hannington.* Collected also in Abyssinia, and by Dr. Rehmann in S. Africa.

Hypnum, *Dill.*

H. (§ Helicodontium) subcompressum, *C. Müll.*—Leskea, *Bruch et Schimp.*

Hab. Kilimanjaro, *Bishop Hannington.*

The few stems gathered agree very nearly with the original, collected by Schimper in Abyssinia (Un. Itin. 481 *b*). The species very closely agrees with the S.-American *H. conostomum* (*Eriodon*), Montagne, and the *H. Sprucei* and *H. salicicola.*

H. (§ Helicodontium) usagarum, sp. n. Monoicum, pusillum, repens; folia patentia ovato-lanceolata, margine superiore subserrulata, nervo longe infra medium obsoleto, cellulis superioribus parvis oblongis, inferioribus ad angulos densioribus quadratis, perichætialia apicibus subulatis; theca in pedunculo lævi suberecta ovalis, operculo rostro subulato, peristomio dentibus angustis pallide rubris, interno processus ciliiformibus æquilongis rufidulis.

Hab. Usagara Mountains, on decayed wood, *Bishop Hannington.*

Caulis 5–6 mm. longus cum foliis 0·75 mm. latus; folia pallide viridia subnitida, 0·50 mm. longa; pedunculus 5 mm. longus, ruber; theca matura viridis, 0·70 mm. longa. Operculi rostrum paullo brevius.

H. (§ Rigodium) toxarion, *Schw.*

Hab. Kilimanjaro, *Bishop Hannington.*

The specimens are without fruit; but they present no differences from states of the species as found on the western side of S. America. The African specimens agree very nearly in size and colour with those collected by Lechler (629), which were named by Schimper *Rigodium Lechleri*, and described by C. Müller in Bot. Zeit. 1858, p. 172, as *Hypnum arborescens*; these are rather a small state; other Chilian examples, and especially those from Chiloe, are much more grown-out, but in foliage and other particulars present no differences. The species is remarkable for its rigid stems, ramification, and foliage, which resemble those of the larger *Thuidia*, without, however, having any papillæ.

H. (§ Brachythecium) implicatum, *Hornsch.*

Hab. Kilimanjaro, *Bishop Hannington.*

Gathered in S. Africa by most collectors.

Brachythecium Dicksoni, Rehm. 383*b*, and *B. Knysnæ*, C. Müll., Rehm. 387, seem to be almost the same species. *B. afro-salebrosum*, C. Müll. Rehm. 385, is more robust. *B. vellerum*, Mitt., from the Cameroons, is larger and very similar to *B. salebrosum*; its capsules are erect.

ANOMODON, *Hook. et Tayl.*

A. DEVOLUTUS, *Mitt.*

Hab. Kilimanjaro, *Bishop Hannington.*

A few stems only, which seem to agree with the Indian species, and are, with it, probably not distinct from the American *A. Toccoæ*, Sull.

LESKEA, *Hedw.*

L. CLAVIRAMEA.—Pseudoleskea, *C. Müll.*

Hab. Kilimanjaro, *Bishop Hannington.*

Imperfect specimens, which agree better with Dr. Rehmann's so named than with the *Pseudoleskea plagiostoma*, Schimp., from Abyssinia.

THUIDIUM, *Schimp.*

T. LÆVIPES, sp. n. Monoicum; caulis pinnatim divisus phyllidiis vestitus, ramis simplicibus, ramulis paucis nudis; folia caulina hastato cordata sicca incurva, nervo infra apicem evanescente, ramea compressa patula ovali-oblonga oblique acuta asymmetrica lateralia semitorta planiuscula, marginibus minute crenulatis, cellulis rotundis minutis obscuris areolata, nervo infra apicem evanescente pallidiore, perichætialia elongata apicibus subulatis inferne breviter fimbriata; theca in pedunculo lævi horizontalis ovalis.

Hab. Kilimanjaro, *Bishop Hannington.*

Habit and size that of *T. versicolor*, Hornsch.; but different in the form of its branch-leaves. A considerable number of nearly allied species have already been described from Africa, many of them having, like *T. gratum*, a rough fruit-stalk.

T. TAMARISCINUM, *Hedw.*

Hab Kilimanjaro, *Mr. H. H. Johnston* and *Bishop Hannington.*

Corresponding in all respects with European specimens. It has been collected in S. Africa by Cooper.

FISSIDENS, *Hedw.*

F. CELLULOSUS, sp. n. Pusillus flaccidus decumbens; folia alterna oblongo-lanceolata acuta ubique limbo e duplici serie cellularum anguste marginata, nervo angusto obscuriore infra apicem evanido; cellulis magnis oblongo-hexagonis pellucidis areolata.

Hab. Usagara Mountains, on the earth, *Bishop Hannington.*

Caulis 3–6 mm. altus pallidus tenuis. Folia patentia 1·50 mm. longa.

These very incomplete specimens indicate the presence of another species of that small group which contains *F. hyalinus*, *F. dealbatus*, and the *Conomitrium* (§ *Polypodiopsis*) *Metzgeria*, C. Müll., with a very lax pellucid areolation and an incomplete or obsolete nerve.

PLAGIOCHILA, *Nees et Mont.*

P. SARMENTOSA, *Lehm.*

Hab. Kilimanjaro, *Bishop Hannington.*

The specimens are larger than those figured by Lindenberg, and in this they agree with some collected on Table Mountain by Mr. Eaton. Other specimens still more elongate have been collected at Fernando Po, *Mann*, on the Niger, *Barter*; and closely similar ones were sent out of M. Bojer's herbarium at Mauritius by Dr. Ayres. All these seem to be really states of one species, which varies in colour and in stature, but very little in the outline of its leaves, which is similar to that of the European *P. asplenioides.*

P. DICHOTOMA, *Web.*

Hab. Kilimanjaro, gathered by Dr. Meller on Mount Chiradzura, *Livingstone's Zambesi Expedition.* It is also from the Cameroons and Niger.

P. TEREBRANS, *Nees.*

Hab. Usagara Mountains and Kilimanjaro.

P. SQUAMULOSA, *Mitt. in Journ. Linn. Soc.* vii. p. 165.

Hab. Kilimanjaro.

P. SINUOSA, sp. n. (Pl. XVI. figs. 8–10.) Rami ramulis subpinnatim in flabellum dispositi phyllidiis pluribus parvis lanceo-

latis ventralibus obsiti; folia conferte imbricata fere ubique æqualia deltoidea, apice truncata rotundata pauci breviter dentata integerrimave, margine ventrali usque ad basin rotundatum pluries sinuato undulata integerrima, dorsali integerrima basi flexura quasi rotundato dilatato caulem cum basis folii oppositi omnino tegente, involucralia conformia apice margine ventrali labiisque perianthii obovati subtruncati undulati spinoso-dentata.

Hab. Kilimanjaro, *Bishop Hannington.* Usagara Mountains, *Last.* Madagascar, *Baron and Pool.* Mauritius, *Thomas.*

PLAGIOCHILA JAVANICA, *Nees et Mont.*

Hab. Kilimanjaro. Gathered in S. Africa by Cooper, and on Table Mountain by Mr. Eaton.

P. LASTII, sp. n. (Pl. XVII. figs. 1–3.) Rami ramulis paucis irregularibus subpinnati; folia patula divaricatave ovato-oblonga, apice satis angusta dentibus variis, margine dorsali recurva decurrente, ventrali e medio ad apicem paucidentata, basin versus rotundata plus minusve dentata, e cellulis rotundatis areolata involucralia latiora, margine ventrali spinoso-dentata, perianthium obovatum, ala dorsali apice dentata, labiis subtruncatis spinoso-dentatis; spicæ masculæ apicibus foliorum rotundatis divaricato-recurvis rotundatis integerrimis.

Hab. Usagara Mountains, *Last.*

This somewhat resembles small *P. cristata*, Sw., and *P. Neckeroidea*, Mitt. in Trans. Linn. Soc. xxiii. t. 6; but it differs in the more entire leaves of a different form.

P. BARTERI, sp. n. (Pl. XVI. figs. 11, 12.) Rami dichotomi furcatimvæ divisi; folia imbricata divergentia ovato-ligulata, apice rotundata margineque ventrali breviter dentata basin versus dentibus longioribus magis approximatis, dorsali recurva in caulem longum descendente basi denticulis circiter tribus ciliata.

Hab. Sierra Leone, *Barter.*

P. DICRANA, sp. n. (Pl. XVII. figs. 4–6.) Rami furcati; folia imbricata a basi latiora patente sensim angustata subligulata curvata falcata divergentia, apice in crura duo subulata sinu lato divisa, margine dorsali integerrima, ventrali dente brevi versus medium imposito integerrimove involucralia, margine ventrali inferiore spinoso-dentato; perianthium obovatum, dorso ala continua integerrima, labiis rotundatis breviter ciliato-dentatis.

Hab. Madagascar, Andrangoalaka, *G. W. Parker.* Central region, *Baron.*

P. ABYSSINICA, sp. n. (Pl. XVII. figs. 7–9.) Rami ramulis paucis pinnatim dorsi latere ventrali ramentis crispulis vestiti; folia imbricata patenti-divergentia deltoideo ovata, apice lata rotundata obtusissima, margineque ventrali breviter denticulata basin versus integerrima sinuato-undulata, dorsali integerrima recurva quasi abrupta caulem tegente, involucralia conformia vix majora denticulis parum majoribus, perianthium obovatum, ala dorsali angusta, apice paucidenticulato, labiis rotundatis dentibus brevibus.

Hab. Abyssinia, *Schimper.*

LEIOSCYPHUS, *Mitt.*

L. INFUSCATUS. (Pl. XVII. figs. 10–14.)—L. repens, *Mitt. in Journ. Linn. Soc.* vii. p 165.

Hab. Kilimanjaro.

The habit of this species is nearly that of *Lophocolea bidentata*; and in all the specimens the colour is brown. This is in most respects very similar to a species collected in Java by Motley:—

L. MOTLEYI; foliis suborbiculatis integris apiceve sinu latiusculo breviter bidentata, amphigastria caule vix latiora quadridentata, perichætialia breviter dentata, perianthium oblongum, labiis rotundatis brevidentatis.

Hab. In monte Megamendong, alt. 4000–6000 ped., ad lignum putridum. Excepting the rounder leaves, there seems to be little difference.

JUNGERMANNIA, *Linn.*

J. MINUTA, *Dicks.*

Hab. Kilimanjaro, amongst *Oncophorus cyathicarpus, Mr. H. H. Johnston.*

CHANDONANTHUS, *Mitt. in Hook. Handb. N. Zeal. Fl.* ii. 753.

C. HIRTELLUS.—Jungermannia hirtella, *Web.*—J. fimbriata, *Hook. Musc. Exot.* t. 79.

Hab. Kilimanjaro; also a single stem amongst moss sent from the Usagara by Mr. Last.

The leaf in the original specimen from Richard is four-lobed; the fourth being small, was overlooked in the figure.

Besides the above, five species referable to this group are known:—*C. javanicus*, from Java; *C. indicus* and *C. rufus* (*Jung. tripartita*, Tayl. ?), *C. squarrosus*, from New Zealand; and *C. fimbriatus*, from Tahiti.

Lepidozia, *Dumort.*

L. cupressina, *Lindenb.*—Jungermannia, *Sw.*
Hab. Kilimanjaro.

Tall and much-branched specimens, some with perianths; they seem to agree very nearly with Swartz's original specimen in the form and substance of the leaf, although the stems and branches are longer.

Bazzania, *Gray.*

B. convexa.—Jungermannia convexa, *Thunb.*
Hab. Usagara Mountains and Kilimanjaro.

B. pumila, sp. n. (Pl. XVIII. figs. 1, 2.) Humilis, dense cæspitosa; caulis ramis dichotomis flabellatim dispositis; folia opposita patenti-divergentia imbricata late ovata, margine dorsali arcuato, ventrali subrecto, apice truncato dentibus plus minusve distinctis subtridentata, cellulis carnosulis rotundis ovalibusque subpellucidis, amphigastria quadrato-rotundata, apice erosa, basi cum basibus foliorum utroque anguste confluente coalita.
Hab. Kilimanjaro.

Much less than *B. decrescens*, so common in Mauritius, and with its areolation of smaller cells.

B. deflexa.—Herpetium deflexa, *Nees.*
Hab. Kilimanjaro.

Isotachis, *Mitt.*

I. Auberti.—Jungermannia Auberti, *Schw.*—J. serrulata, *Hook. Musc. Exot.* t. 88.
Hab. Kilimanjaro. A fragment only, *Bishop Hannington.*

Herberta, *Gray.*

H. dicrana, *Tayl.*
Hab. Kilimanjaro.

The specimens agree very nearly with Indian, both in ramification and foliage, but are barren.

Radula, *Dumort.*

R. Boryana, *Nees.*
Hab. Kilimanjaro.

R. appressa, *Mitt.*
Hab. Kilimanjaro.

R. mascarena, *Steph.*
Hab. Kilimanjaro.
Fragments of some other species were also gathered.

Porella, *Dill.*

P. capensis.—Madotheca capensis, *Göttsche.*
Hab. Usagara Mountains, *Bishop Hannington.*
Very different in appearance from the S.-African specimens, being deep green and luxuriant.

Phragmicoma, *Dumort.*

P. florea, sp. n. (Pl. XVIII. figs. 3, 4.) Monoica; rami dichotomi flabelliformes; folia divergentia arcuata oblique acuta, margine ventrali sinuata incurva, lobulo obsoleto, amphigastria caulem triplo latiora orbiculata; folia involucralia parum minora subconformia, lobulo parvo ligulæformi, amphigastrium oblongum, apice recurvum sinu parvo bidentatum lateribus dentibus paucis nullisve armatis; perianthia sæpe plura oblonga obtusa, dorso lævia ventre apicem versus unicarinata, spicæ masculæ sæpe prælongæ.
Hab. Niger, *Barter.*
Brown, somewhat flaccid in stratified tufts.

P. emergens, *Mitt.*
Hab. Usagara Mountains and Kilimanjaro; associated with *Leptodon Smithii.*

P. Pappeana, *Nees.*
Hab. Kilimanjaro.
The specimens, mostly barren, appear to belong to this S.-African species.

Lejeunea, *Lib.*

L. (§ Odontolejeunea) tortuosa, *Lehm. et Lindenb.*—Phragmicoma Palisoti, *Tayl.* Flores monoici; perianthium ventre lævi uni- bicarinatumve.

Hab. Usagara Mountains; gathered also by Mr. Last.

L. (§ Odontolejeunea) Hanningtoni, sp. n. (Pl. XVIII. figs. 5–8.) Dioica? ; rami fertiles assurgentes foliis patenti-divergentibus, inferioribus subovalibus obtusis integerrimis, superioribus ovato-oblongis oblique obtusis, margine breviter paucidentatis integerrimisve ventrali incurvis, basi lobulo parvo plicæformi, amphigastriis fere orbiculatis parum longioribus quam latis paucidentatis; foliis involucralibus ovatis acutis amphigastrioque ovali magis dentatis, lobulo fere obsoleto, perianthio obcordato haud exserto carina ventrali marginibusque dentatis; rami masculi foliis patentibus ovato-lanceolatis, lobulo elongato, marginibus amphigastrioque integerrimis.

Hab. Usagara Mountains, on leaves.

L. (§ Lopholejeunea) atra, sp. n. (Pl. XVIII. figs. 9–12.) Monoica, gracilis nigrescens humilis; folia late ovata obtusiuscule acuta, lobulo fere ad medium marginis ventrali producto ovato-oblonga, apice rectangulari, amphigastria caulem triplo latiora orbicularia involucralia majora perianthium obcordatum, limbo dentato alatum, ventre carinulis apice paucidenticulatis tegens.

Hab. Kilimanjaro.

Similar in habit and appearance to *L. subfusca*; but differing from most of the allied species in the outline of its leaves.

L. (§ Lopholejeunea) sinuata, sp. n. (Pl. XVIII. figs. 13–16.) Repens, ramosa; folia ovato-rotundata lobulo ad medium marginis ventralis ascendente ibique sinuata, lobulum subobcordatum ostendente; amphigastria orbiculata caule quadruplo latiora, involucralia majora conformia, lobulo oblongo, perianthio obovato ventre convexo lateribus ala integerrima limbato.

Hab. Mauritius, creeping on bark, *Dr. Ayres.*

L. (§ Prionolejeunea) serrula, sp. n. (Pl. XIX. figs. 1–3.) Monoica; folia ovata acuta, cellulis marginalibus angulis prominulis acutis crenulata grossiuscule areolata, lobulo subovato

involuto, amphigastria caule parum latiora; perianthium obcordatum, marginibus superioribus denticulatis.

Hab. Niger River, creeping on *Plagiochila neckeroidea* (*Barter*).

Lejeunea (§ Prionolejeunea) deplanata, sp. n. (Pl. XIX. figs. 4–6.) Monoica; folia lata ovata obtusa subacutave, margine minute crenulata, cellulis minutis areolata, lobulo obsoleto, amphigastria caule vix duplo latiora; perianthio obcordato, marginibus superioribus crenulatis.

Hab. Island of Bourbon, on *Buzzania decrescens*, ex *herb. Montagne.*

L. (§ Leptocolea) adhæsiva, sp. n. (Pl. XIX. figs. 7–9.) Monoica, ad folia viva repens planissima affixa pinnatim ramosa; folia rotundato-ovata imbricata, margine cellulis tenuissimis angustis a reliquis diversiformibus pallidis limbata, lobulo in laciniam lanceolato-ligulatam ovalemve cauli subparallelam producto in ramis fertilibus subquadrato saccato varieformi; folia involucralia majora obovata lobulis subovatis; perianthium (juvenile?) immersum late obovatum planum ventre linea carinæformi notatum; antheridia in saccis foliorum infra involucralium inclusa.

Hab. Usagara Mountains.

Very pale brown, adhering to the leaves on which it grows as if by the suctorial leaf-margins; in this particular it agrees with many other species of this group. The perianths are all alike and of the same small size, and are probably immature. The form of the lobule is unusual; but the same elongation is seen in the Indian *L. producta.*

L. (§ Colura) digitalis, sp. n. (Pl. XIX. figs. 10, 11.) Repens, pinnatim ramosa; folia patenti-divergentia subovato-oblonga, margine ventrali involuto apice in cucullum oblongum teretem obtusiusculum tertiam partem folii longitudinis occupantem producta amphigastria profunde, bicrura.

Hab. Usagara Mountains, on leaves.

The fragmentary specimens show that this is a species in size and habit approaching the *L. superba* of the Pacific Islands.

L. (§ Ceratanthe) cornuta?, *Lindenb.*

Hab. Usagara Mountains.

The specimens, mere fragments, clearly indicate the presence of a species of this group and, like some others from the western coast, are too incomplete to be certain of their identity.

LEJEUNEA (§ EULEJEUNEA) FLAVA, *Sw.*
Hab. Usagara Mountains.

L. (§ EULEJEUNEA) ACUTA, *Mitt.*
Hab. Usagara Mountains.

FRULLANIA, *Raddi.*

F. ECKLONII, *Spreng.*
Hab. Kilimanjaro and Usagara Mountains.
All the S.-African specimens which appear to belong to this species are not in a condition to show if the inflorescence is uniformly monoicous, as is the case in those from Central Africa and in *F. emergens* from the Cameroons. Similar species are found in India as well as in S. America, and it is most probable that one wide-spread species inhabits all these regions.

F. SQUARROSA, *Nees.*
Hab. Kilimanjaro.

F. USAGARA, sp. n. (Pl. XIX. figs. 12–14.) Caulis ramis paucis remotis, subpinnatim ramosus; folia patentia patulave late ovata apice rotundata, lobulo magno semigloboso evolutove; amphigastria rotunda caule triplo latiora sinu acuto fissa, dentibus acutis ad latera externa paucidentatis; folia involucralia lobulo acuto dentato cum amphigastrio bipartito, laciniis dentatis coalita; perianthium emergens obovatum triquetrum inferne phyllidiis parvis et supra in carinis pluriseriatis asperulum; spicæ masculæ ovales.
Hab. Forest of Ugogo and Usagara Mountains, on bark.
The general appearance of this species is like that of *F. squarrosa*, but it is in all its parts much smaller. The small laciniæ on the two lateral and ventral carinæ of the perianth appear to be arranged in several rows.

F. TRINERVIS, *Lehm. et Lindenb.*
Hab. Kilimanjaro and Usagara Mountains.

F. BRUNNEA, *Spreng.*
Hab. Kilimanjaro. A fragment only.

F. CORDATA, *Mitt. in Journ. Linn. Soc.* vii. p. 168.
Hab. Kilimanjaro.
The inflorescence is in this monoicous.

FRULLANIA ANGULATA, *Mitt. in Journ. Linn. Soc.* vii. p. 169.
Hab. Usagara Mountains.

F. REPLICATA, *Nees.*
Hab. Gold Coast, *Capt. Burton and Com. Cameron.*

METZGERIA, *Raddi.*

M. FURCATA, *Linn.*
Hab. Usagara Mountains.

M. MYRIAPODA, *Lindberg.*
Hab. Usagara Mountains.

CYATHODIUM, *Kunze, Göttsche, Lindenb. et Nees, Syn. Hep.* p. 577.

Synhymenium, *Griffith, Notul.* p. 344.
Riccia, *Dickson,* fasc. 4.

C. AFRICANUM, sp. n. Sporis lævibus; frondes tenerrima pallide viridia sicca chartacea laxe areolata dentes capsulæ octo e seriebus sex cellularum fuscarum conditi; sporæ fuscæ subhemisphæricæ depressæ, margine rotundatæ.

Hab. Usagara Mountains, *Bishop Hannington.*

So far as can be seen in the small quantity obtained, this species is entirely of the same habit and structure as the Indian *C. aureonitens,* Griff. Icon. 69. D. ii. It differs in its smooth spores and probably in the shorter teeth-like divisions of the apex of the capsule; but both species agree in having the involucra situate in the axil of the marginal divisions of the edge of the fronds, as represented by Griffith, and is also shown in the figure given by Dickson of his *Riccia spuria*, fasc. 4, t. ii. fig. 16. The plants appear to grow in their earlier stages radiating from a centre, but soon become confused from the lobes of the same or adjacent individuals growing over them; and as the fructification is concealed from view above, they might be readily passed over as the prothallus of some fern. The areolation is of so loose and tender a substance that it revives after desiccation very irregularly or not at all.

Griffith had the opportunity of examining the Indian species in a living state, and his original drawing has no doubt been so modified by the native artist that the mouth of the involucre is represented as a globular body opening by fissures of which two

are lateral, and these should represent the orifice of the pouch-like involucre, the middle lobe having to all appearance been added by the artist in place of the apex of the capsule, the other figures (2, 3, 4, 6, 7) being true to nature.

TARGIONIA, *Micheli.*

T. HYPOPHYLLA, *Linn.*

Hab. Kilimanjaro and Usagara Mountains.

There seems to be no difference between these specimens and European, the spores are alike in all.

FIMBRIARIA, *Nees.*

F. BORYANA?, *Mont.*

Hab. Kilimanjaro.

Specimens with very young fruit may belong to this.

DESCRIPTION OF THE PLATES.

PLATE XV.

Figs. 1–4. *Archidium africanum*, sp. n. 1, Natural size; 2, portion of stem with perichætium and male flower; 3, stem-leaf; 4, perichætial leaf, enlarged.

Figs. 5–8. *Archidium Rehmanni*, sp. n. 5, Natural size; 6, entire rim; 7, stem-leaves; 8, perichætial leaves.

Figs. 9–12. *Campylopus perpusillus*, sp. n. 9, Natural size; 10, stem-leaves; 11, perichætium with capsule and calyptra; 12, portion of peristome, enlarged.

Figs. 13–16. *Hyophila plicata*, sp. n. 13, Natural size; 14, leaves; 15, capsule with (*a*) calyptra and (*b*) portions of peristome; 16, male flower, all enlarged.

Figs. 17–19. *Anœctangium pusillum*, sp. n. 17, Natural size; 18, leaves; 19, capsule, enlarged.

Figs. 20–22. *Pterobryum Hanningtoni*, sp. n. 20, Natural size; 21, stem-leaves; 22, perichætium, with (*a*) leaf detached.

PLATE XVI.

Figs. 1–3. *Pterobryum flagelliferum*, sp. n. 1, Natural size; 2, stem-leaf; 3, perichætium, enlarged.

Figs. 4–7. *Erpodium Hanningtoni*, sp. n. 4, Natural size; 5, portion of stem with fruit-bearing branch; 6, stem-leaves and (*a*, *b*) sections; 7, capsule and calyptra, enlarged.

Figs. 8–10. *Plagiochila sinuosa*, sp. n. 8, Natural size; 9, leaves; 10, perianth and involucral leaf, enlarged.

Figs. 11, 12. *Plagiochila Barteri*, sp. n. 11, Natural size; 12, leaves, enlarged.

Plate XVII.

Figs. 1–3. *Plagiochila Lastii*, sp. n. 1, Natural size; 2, leaves; 3, perianth with involucral leaf.

Figs. 4–6. *Plagiochila dicrana*, sp. n. 4, Natural size; 5, leaves; 6, perianth and involucral leaf, enlarged.

Figs. 7–9. *Plagiochila abyssinica*, sp. n. 7, Natural size; 8, portions of stem with leaves; 9, perianth and involucral leaf, enlarged.

Figs. 10–14. *Leioscyphus infuscatus*, nob. 10, Natural size; 11, portion of stem with leaves; 12, amphigastrium; 13, involucral leaves and perianth; 14, perianth seen from the side, enlarged.

Plate XVIII.

Figs. 1, 2. *Bazzania pumila*, sp. n. 1, Natural size; 2, portion of stem with leaves and amphigastrium.

igs. 3, 4. *Phragmicoma florea*, sp. n. 3, Stem, natural size; 4, portion of same with perianth and male spike, enlarged.

Figs. 5–8. *Lejeunea* (§ *Odontolejeunea*) *Hanningtoni*, sp. n. 5, Natural size; 6, portion of stem with leaves; 7, fertile branch and (*a*) section of perianth; 8, portion of male spike, enlarged.

Figs. 9–12. *Lejeunea* (§ *Lopholejeunea*) *atra*, sp. n. 9, Natural size; 10, portion of stem with leaves and amphigastria; 11, perianth and involucral leaves; 12, transverse section of perianth.

Figs. 13–16. *Lejeunea* (§ *Lopholejeunea*) *sinuata*, sp. n. 13, Natural size; 14, portion of stem with leaves and amphigastrium; 15, perianth with involucral leaves; 16, transverse section of perianth.

Plate XIX.

Figs. 1–3. *Lejeunea* (§ *Prionolejeunea*) *serrula*, sp. n. 1, Natural size; 2, portion of stem with leaves and amphigastria; 3, perianth with involucral leaves and (*a*) transverse section, enlarged.

Figs. 4–6. *Lejeunea* (§ *Prionolejeunea*) *deplanata*, sp. n. 4, Natural size; 5, portion of stem with leaves and amphigastria; 6, involucral leaves and perianth with (*a*) its transverse section.

Figs. 7–9. *Lejeunea* (§ *Leptocolea*) *adhæsiva*, sp. n. 7, Natural size; 8, portion of stem with leaves and (*a*) cells more enlarged; 9, fertile branch.

Figs. 10–11. *Lejeunea* (§ *Colura*) *digitalis*, sp. n. 10, Natural size; 11, portion of stem with leaves and amphigastria, enlarged.

Figs. 12–14. *Frullania usagara*, n. sp.? 12, Natural size; 13, portion of stem with leaves and amphigastria; 14, perianth and involucre, enlarged.

Note on *Balanophora Thwaitesii*, Eichl.

By Henry Trimen, M.B., F.L.S.

[Read 3rd June, 1886.]

At the commencement of the present year my friend Mr. Fawcett, of the British Museum, then engaged on the paper upon certain *Balanophoreæ* which he has since communicated to this Society, wrote to me in Ceylon asking me if I could give him any information about a plant mentioned by Eichler in his monograph of the Order in the 'Prodromus,' and named by him *Balanophora Thwaitesii*, but not described. In reply I informed Mr. Fawcett what material existed at Peradeniya; and this I have brought home with me, and now exhibit to the Society in illustration of this note, which can be regarded only as a small addendum to Mr. Fawcett's paper.

The name *B. Thwaitesii* was given ("pro tem.") in 1873 * to a supposed new species from Ceylon, represented only by a coloured drawing of a male plant, sent by Thwaites to the Kew herbarium †. Eichler's MS. note attached to this drawing is as follows:—"Hæc nova species mihi videtur nomine *Balanophora Thwaitesii* in DC. Prod. commemorata nec tamen descripta." In the 'Prodromus' he gives the few characters visible in the drawing; but nothing further has been published concerning the plant.

The original specimens from which the drawing was made are preserved in the Peradeniya herbarium, and are now exhibited. They were collected in "Dec. 1854" at Raxawa, a place at an elevation of some 4000 feet. The late Dr. Thwaites ‡ did not distinguish them from *B. indica*, and placed them under the same C.P. number 200. No female specimens were collected.

In January 1881 one of the Garden coolies brought me fine living specimens, both male and female, of this plant, which he said he had collected at Nuwara Eliya, a locality at over 6000 feet elevation. From an examination of this fresh material § I then arrived at the conclusion that Eichler was correct in considering the plant distinct as a species from *B. indica*; and in

* DC. Prod. xvii. p. 146.

† Being a facsimile of one in the Peradeniya Collection.

‡ Thwaites, Enum. Fl. Zeyl. p. 293 (1861).

§ I regret that, not knowing at the time the rarity of the plant, I preserved dried specimens only, and put none into spirit.

my recently published List of Ceylon Plants * I so entered it. It has not been again met with in Ceylon, and must be rare, whilst *B. indica* is very frequent in the mountain forests †.

The following description of *B. Thwaitesii* was made from the living plants above mentioned:—*Rhizome* coral-like, much branched or lobed, studded at intervals with very large stellate pustules; heads apparently diœcious, bursting irregularly through the rind of the rhizome, ultimately rather long-stalked. *Male plant* entirely bright lemon-yellow, the young bracts orange-coloured, peduncle variable in length, completely concealed by large fleshy, elongated, oblong-obtuse decurrent leaf-scales, which pass into flower-bracts above; flower-bracts always conspicuous, being as long as the buds in the upper part and as the pedicels of fully opened flowers below, thick and fleshy, strongly ribbed above and channelled beneath so that the ends are crenate in outline; flowers large, not very densely crowded; perianth-segments over $\frac{3}{8}$ inch long, reflexed; anther-head $\frac{1}{4}$ inch, cells hippocrepiform. *Female plant* rather taller, the head 3 inches by $2\frac{1}{4}$, ovoid-clavate, and exserted beyond the leaf-scales, brownish yellow; flowers minute, the ovaries shortly stalked, ovoid or pyriform, nearly always inserted on the receptacle, and surrounding the bases of the stalked oblong-ovate truncate brownish spadicels; styles very long, tapering, somewhat exceeding the spadicels.

The whole plant is full of a waxy juice and has a strong mousy smell. Its large size and bright yellow colour give it at first sight a very different look from *B. indica*, but yet it is difficult to formulate definite characters. Those which appear to be the most valuable are:—the large size of the stellate pustules on the rhizome, the prominent, longer, crenated flower-bracts of the male heads, the ovoid or pear-shaped exserted female flower-heads, and the short-stalked female flowers (ovaries) inserted on the receptacle and very rarely attached to the bases of the spadicels. I had hoped that this last character would have proved an absolute one, the rest being merely comparative; but a further examination and comparison along with Mr. Fawcett has shown me that occasionally the ovaries have their insertion on the spadicel-stalks, as in *B. indica*.

* Trimen, Syst. Cat. Ceylon Plants, p. 77 (1885).

† The specimens in spirit of *B. indica* exhibited were collected by Prof. Bower of Glasgow, during his visit to Ceylon in the early part of this year.

B. Thwaitesii should be searched for in the S.-Indian mountains. In looking over the sheets of *B. indica* in the British Museum, a female plant collected by Wight in the Nilgiris came under notice, which may probably be the same. The flowers, however, are very much destroyed, which renders the disposition of the ovaries somewhat uncertain.

In the Kew Herbarium is a male plant from Ceylon (Gardner, no. 839) which is unlike the usual condition of *B. indica*; but it is too young to enable one to say positively that it is *B. Thwaitesii*. Possibly this may be one of the specimens referred with doubt to *B. elongata* by Dr. (now Sir) Joseph Hooker in his well-known paper in our Transactions*.

Whether *B. Thwaitesii*, Eichl., is entitled to rank as a species may remain a matter of opinion until further investigation. I am inclined now rather to regard it as a well-marked variety of *B. indica*. No doubt it will again be met with in Ceylon, and this note may assist its identification in Peninsular India or Malaya.

Report on the Vegetation of Diego Garcia. By W. BOTTING HEMSLEY, A.L.S., Assistant for India in the Herbarium, Royal Gardens, Kew.

[Read 17th June, 1886.]

DIEGO Garcia is the name of an island and three contiguous islets forming part of the Chagos Archipelago, in the Indian Ocean, and lying in about the same latitude and eighteen degrees east of the Seychelles, and in the same longitude as the Laccadive and Maldive Islands. They are a dependency of the Mauritius, yet until recently nothing definite was known of their vegetation. Though smaller in extent than the largest island of the Seychelles, it was thought possible that they might also possess an endemic element in their flora, especially as the only plant recorded from Diego Garcia was a Fern, *Asplenium æquabile*, Baker, which is not known to occur elsewhere.

* Trans. Linn. Soc. xxii. p. 45 (1855).

Bory de St. Vincent ('Voyage dans les quatre Principales Iles des Mers d'Afrique,' 1804, iii. p. 247), refers to the islands in these words:—"On arme à l'Ile de France diverse embarcations, qui ne font d'autre commerce que d'aller a Praslin à Diégo Garcias et sur d'autres ecueils chercher des cocos pour en faire de l'huile." In 1885, in connection with the expedition of Mr. Bourne, to be referred to hereafter, Prof. Moseley, F.R.S., kindly drew the attention of the Director of Kew to the following extract from Findlay's 'Directory for the Navigation of the Indian Ocean,' 2nd ed. London, 1870, p. 459:—"On nearly every part of these islands there grow at intervals great clumps of gigantic trees, the Bois Mapan or Rose Tree, which attains an enormous size and height, even to 200 feet. Their growth and decay is most rapid, and their fallen and decayed trunks form a large portion of the vegetable world of the Archipelago." This statement increased our desire that the islands should be explored botanically. In 1883 an opportunity occurred. H.M.S. 'Moorhen' was to call at Diego Garcia on her homeward voyage from China; and at the instigation of Mr. Wykeham Perry (Secretary to the Commodore in Chief, China Station), Mr. A. Hume (Assistant Paymaster, R.N.) made a small collection of plants there and forwarded them to Kew. This collection, although regarded as very imperfect by Mr. Hume, dispelled to a great extent the idea of the existence of endemic forms, as it consisted entirely of the commonest of tropical littoral plants. Nevertheless it did not conclusively prove that the flora was wholly of comparatively recent derivation, and as Diego Garcia had by this time been made a coaling-station of the 'Orient' line of steamers from London to Australia, an opportunity for a more complete exploration was not far distant. In 1885 Mr. Gilbert C. Bourne, F.L.S., was furnished with funds by the Government Grant Committee of the Royal Society for investigating the marine invertebrate fauna, and he at the same time undertook to botanize the islands. This he appears to have done thoroughly; but before proceeding to discuss his collection, I will here give some particulars concerning the islands, communicated by Mr. Bourne.

"Diego Garcia," he writes, "is an Atoll fourteen miles long by six miles and a half broad, entirely of coral formation, and nowhere rising more than ten feet above high tide, excepting where, in a few places, sand heaps have been piled up by the

wind. The ring of land encircling the lagoon is nearly continuous, and averages one third of a mile in width. At the north end the strip of land is discontinuous; here there is an entrance into the harbour five miles wide, broken up by three small islets into four channels. The whole of the main island is densely covered with vegetation, *Scævola Koenigii* and *Tournefortia argentea* reaching down to the high-tide level on either shore, and forming, especially the *Scævola*, a thick impenetrable mass along both shores. Within this mass of bushes come cocoa-nut palms, which have been artificially planted only in a few places; over the larger part of the island they have grown wild. The undergrowth beneath the palms is often very thick, consisting generally of *Guettarda speciosa*. There are no cocoa-nut trees on the three islands in the mouth of the harbour; but the whole of the main island is densely covered with them. I have frequently seen cocoa-nuts germinating on the shores in places where the young plant was lapped by the waves at the highest spring-tides; these young plants seemed to be perfectly healthy. The shores are not, I should think, favourable for the germination of many kinds of seeds that may be fortuitously brought to them, being composed almost entirely of coral blocks or coral-sand. There is a little cultivation in the island at the three principal habitations of Point Marianne on the west side of the island, and East Point and Minny Minny on the east side. In the Gardens bananas, sweet potatoes, bitter oranges, citrons, and a few other tropical fruits are grown. Maize is cultivated at Minny Minny. I have forgotten to mention that the banyan tree occurs on the island. There are several large specimens, but it does not appear in my collection, for it neither flowered nor fruited during my stay. The only noticeable feature about it is that, owing no doubt to the poverty of the soil, its leaves are much smaller than usual."

In connection with the vegetation of oceanic islands generally I published a list of the plants collected by Mr. Hume in the Botany of the 'Challenger' Expedition, part 3, p. 115, omitting, however, to add the sign of doubt after the name *Achyranthes velutina*, Hook. et Arn. This list and the collections sent by Mr. Bourne the latter part of last year and the beginning of this, prove that the flora of Diego Garcia is altogether derivative, and apparently of comparatively recent derivation. The fern, *Asple-*

nium æquabile, Mr. Bourne sought in vain; consequently some doubts arise concerning the home of the original specimen sent by Lady Barkly; but if it exist in Diego Garcia, it must be exceedingly scarce. As to the gigantic trees of Findlay's 'Directory' Mr. Bourne writes:—"The inhabitants knew nothing of any such trees, and pointed out *Pisonia* as being the largest tree on the island. That same Directory makes several remarkable and untrue statements about the island, among which must be classed the gigantic trees."

Without accepting the enormous dimensions recorded in Findlay, I think there is a probability that the statement as to the former existence of large trees was based upon facts; and "Bois Mapan" is perhaps a misprint for Bois Mapou, the name of a district in Mauritius, and a name applied to various trees in different islands of the Indian Ocean. At the present day, according to Mr. Bourne, *Pisonia inermis*, the largest tree in the island, bears the name of Bois Mapou in Diego Garcia; and on the authority of Dr. Balfour ('Botany of Rodriguez,' p. 64), the endemic *Pisonia viscosa* is known by the same name in Rodriguez.

Going farther back, it appears from Bojer ('Hortus Mauritianus,' p. 265), that this name was applied to *Pisonia macrophylla* in the island of Galega, and to *Cissus Mappia* in Mauritius itself, where it has given the name to a district; while in Maillard's 'Notes sur l'Ile de la Réunion,' 2me éd. i. p. 145, it is stated that *Monimia rotundifolia* is the Mapou of Bourbon Island. What the meaning of the word "Mapou" may be is not evident; but as it is employed to designate such very different trees as those named, it may well have included another in former times.

It is very probable, however, that the statement in Findlay's Directory is a jumble of fact and fiction, and all that we can accept of it is that there were formerly clumps of large trees all over the island. Mr. Thiselton Dyer suggests that the big tree of earlier times was the "Gayac" (*Afzelia bijuga*), basing his opinion on a passage in an unpublished report on the timber trees of the Seychelles by Mr. C. Button, Crown Conservator of Forests, Seychelles. He says:—"This tree, already very scarce, acquires gigantic proportions, more especially in the sandy flats, the largest trees having been found in the Chagos group, Solomon,

Six Iles, &c.; their diameter attaining six or seven feet, and their height fifty or sixty feet from the base to the branches. Its timber has been so much sought after that in many places it has been completely destroyed without pity, and its place taken by cocoa-nut trees. Gayac is in great demand for ship-building; nearly all the ships built at Seychelles having been principally constructed of this wood."

The Gayac is a member of the Leguminosæ found in the Seychelles, Madagascar, the Malay peninsula and archipelago, and in Western Polynesia, and is everywhere valued for its timber. When Mr. Bourne was at Diego Garcia there was only one clump of four or five trees remaining; and he was informed that it did not increase in consequence of the rats eating the seeds as soon as they fall.

Cordia subcordata is another tree inhabiting Diego Garcia which attains a large size, but only when it forms forests in humid situations. On the authority of Forster (Seemann, 'Flora Vitiensis,' p. 169), it occasionally reaches a height of eighty feet and upwards; and when Darwin visited the Keeling Islands, in the eastern part of the Indian Ocean, there were considerable forests of it in those islands. Still this could scarcely have been the "Bois Mapan" of Diego Garcia, because it has a very hard durable wood. *Hibiscus tiliaceus*, a common oceanic tree, not now found in Diego Garcia, grows rapidly and has a soft perishable wood. But what the large trees of Diego Garcia were must remain conjectural, unless there are any records in the Paris Museum, for it seems that the French surveyed and explored the islands in 1744, though no results have been published.

Below is a tabular view of the probably indigenous plants of Diego Garcia with their general distribution.

A List of the Vascular Plants found in Diego Garcia, which probably reached the Islands independently of the agency of Man*.

	Africa.	Asia.	Polynesia.	Australia.	America.
PORTULACACEÆ.					
1. Portulaca quadrifida, *Linn.*	*	*	*		
MALVACEÆ.					
2. Sida diffusa, *H. B. K.*	S.	...	*	...	*
TILIACEÆ.					
3. Triumfetta procumbens, *Forst.*	S.	...	*	...	*
SIMARUBEÆ.					
4. Suriana maritima, *Linn.*	*	*	*	*	*
LEGUMINOSÆ.					
5. Afzelia bijuga, *A. Gray*	S. & Mad.	*	*		
COMBRETACEÆ.					
6. Terminalia Catappa, *Linn.*	M.	*	*		
MYRTACEÆ.					
7. Barringtonia speciosa, *Linn. f.*	M.	*	*	*	
RUBIACEÆ.					
8. Morinda citrifolia, *Linn.*	*	*	*	*	*
9. Guettarda speciosa, *Linn.*	*	*	*	*	
COMPOSITÆ.					
10. Vernonia cinerea, *Less.*	*	*	...	*	
11. Ageratum conyzoides, *Linn.*	*	*	*	*	*
GOODENOVIEÆ.					
12. Scævola Koenigii, *Vahl*	...	*	*	*	
APOCYNACEÆ.					
13. Ochrosia borbonica, *Gmel.*	*	*			
BORAGINEÆ.					
14. Cordia subcordata, *Lam.*	*	*	*	*	
15. Tournefortia argentea, *Linn. f.*	*	*	*	*	
CONVOLVULACEÆ.					
16. Ipomœa grandiflora, *Lam.*	*	*	*	*	
17. —— biloba, *Forsk.*	*	*	*	*	*
SCROPHULARINEÆ.					
18. Herpestis Monniera, *H. B. K.*	*	*	*	*	*
19. Striga hirsuta, *Benth.*	*	*	*	*	

* In the African column S. denotes Seychelles, M. Mauritius, and Mad. Madagascar; and the plants to which they refer have not been found in Continental Africa.

	Africa.	Asia.	Polynesia.	Australia.	America.
VERBENACEÆ.					
20. Lippia nodiflora, *Michx.*	*	*	*	*	*
21. Premna serratifolia, *Linn.*	*	*	*	*	
NYCTAGINEÆ.					
22. Boerhaavia diffusa, *Linn.*	*	*	*	*	
23. Pisonia inermis, *Forst.*	...	*	*	*	
AMARANTACEÆ.					
24. Achyranthes aspera, *Linn.*	*	*	*	*	*
LAURINEÆ.					
25. Hernandia peltata, *Meissn.*	*	*	*	*	
26. —— ovigera, *Linn.*	*	*			
27. Cassytha filiformis, *Linn.*	*	*	*	*	*
EUPHORBIACEÆ.					
28. Euphorbia pilulifera, *Linn.*	*	*	*	*	*
29. Phyllanthus Niruri, *Linn.*	*	*	*	*	*
30. Acalypha indica, *Linn.*	*	*	*		
CASUARINEÆ.					
31. Casuarina equisetifolia, *Forst.*	*	*	*	*	
CYPERACEÆ.					
32. Cyperus ligularis, *Linn.*	*	*	*	*	*
33. Kyllinga monocephala, *Rottb.*	*	*	*	*	*
34. Fimbristylis glomerata, *Nees*	*	*	*	...	*
GRAMINEÆ.					
35. Panicum sanguinale, *Linn.*	*	*	*	*	*
36. Stenotaphrum complanatum, *Schrank.*	*	*	*	*	*
LYCOPODIACEÆ.					
37. Psilotum triquetrum, *Linn.*	*	*	*	*	*
FILICES.					
38. Asplenium æquabile, *Baker*					
39. —— longissimum, *Blume*	M.	*			
40. —— Nidus, *Linn.*	*	*	*	*	
41. —— falcatum, *Lam.*	*	*	*	*	
42. Nephrodium unitum, *R. Br.*	*	*	*	*	*
43. Pteris marginata, *Bory*	*	*	*	*	

Of the thirty-six flowering plants in the foregoing table, fifteen are trees or shrubs; and fourteen of the total occur in Africa (or the Mascarene Islands), Asia, Polynesia, Australia, and America; twenty-five in four out of five of these geographical areas; and thirty-four of them in three of the areas.

Mr. Bourne writes that he believes they fully represent the

indigenous flora of Diego Garcia, except the "Lily of the Island," which he was unable to preserve, from the effects of damp after drying a specimen. This "Lily" is probably one of the common maritime species of *Crinum*, though Mr. Bourne was of opinion that it was peculiar to the islands *.

From what is known of the distribution of the plants here treated as indigenous, they may have all reached the islands by natural means, such as oceanic currents and birds; yet it is also possible that some of them may have been intentionally or unintentionally introduced by man. Mr. Bourne states that he was careful not to collect evidently introduced plants; but the following collected by him can only be classed as such:— *Gossypium barbadense*, Linn., *Triphasia trifoliata*, DC., *Passiflora suberosa*, Linn., *Asclepias curassavica*, Linn., *Capsicum frutescens*, Linn., and *Rivina lævis*, Linn.; hence they were not included in the table.

It would unduly lengthen this sketch to enter into details respecting the diffusion of each species of the native plants; yet I may be permitted to add that full particulars on this point for nearly all of them are given in the Botany of the 'Challenger' Expedition. Not one species is restricted even to the islands of the Indian Ocean; thus *Ochrosia borbonica*, which, more than any other, is characteristic of the region, is also found in the tidal forests of Ceylon, the Andaman Islands, and Singapore. It has, however, been proved that the seeds of most of them are uninjured by long immersion in the sea that they are often cast ashore on remote islands in a germinating condition, and that some of them at least are chiefly littoral in their wide distribution from these causes, but they flourish equally well beyond the immediate influence of the sea.

Mr. Bourne collected a few cellular Cryptogams, including some new forms, descriptions of which are appended.

MUSCI.

CALYMPERES (§ HYOPHILINA) GARCIÆ, *Mitt.*, n. sp.

"Cæspitosum, humile; folia supra basin erectam pallidam obovatam, margine superiore crenulatam, intus cellulis pellucidis

* Since writing the foregoing, I have seen a young plant of a *Crinum* raised at Kew from seed sent thither by Sir John Kirk, who obtained it from Diego Garcia. Until the plant flowers it will be impossible to determine the species, but Mr. Baker regards it as being nearly allied to *Crinum Hildebrandtii*, Vatke (Bot. Mag. t. 6709), a native of the mountains of Johanna Island.

areolatam patentia oblongo-ligulata, apice obtusiuscule mucronata sæpius autem angustata anomala, cellulis minutissimis haud opacis areolata, nervo crassiusculo dorso minute scabro percursa, margine incurva integerrima, limbo ubique carente.

"Island of Diego Garcia, *Mr. G. C. Bourne.*

"More slender than the best known species of this group, which agree generally with the African *C. Afzelii*, and differing in the entire absence of the marginal or intramarginal limb. In some species from the islands of the Pacific the limb becomes obsolete, but in these the leaf-outline is usually wider."—W. Mitten.

Algæ.

Caulerpa mamillosa, *Mont.*

"Cladophora demissa, *J. Ag. MSS.*, ad nullam descriptam speciem hanc referre ausus sum.

"De hac mihi adnotavi:

"Ad Confervam Echinus habitu paulisper accedit, at structura abunde diversa, fere *Valoniam* referens (insunt inter fila Confervæ fragmenta Corallinæ et Microdictyi).—J. G. Agardh."

"Dasya indica, *J. Ag. MSS.*, est species nondum descripta.

"De hac specie mihi adnotavi: Nonnullis characteribus ad *Dasyam stuposam* J. Ag. (Sp. Alg. vol. ii. pars 3, p. 1197) = *D. crassipes*, Harv. Alg. Ceylon, no. 7 (non Harv. Austral.); aliis characteribus ad *Dasyam Cardicanam* accedit. Frons est inferne corticata, ramulis fasciculato-fastigiatis sursum porrectis, subsecundatis, inferiore parte articulata at corticata, superiore monosiphonia.—J. G. Agardh."

Halimeda Opuntia, *Lamour.*

Sargassum, sp. (too imperfect for determination).

Turbinaria vulgaris, var. decurrens, *J. Ag.*

Fungi.

Polyporus sanguineus, *Fries.* An almost cosmopolitan species.

Phytobiological Observations; On the Forms of Seedlings and the Causes to which they are due.

By Sir JOHN LUBBOCK, Bart., Pres. Linnean Society, F.R.S., M.P., D.C.L., LL.D.

[Read as a Presidential Address, 24th May, 1886.]

FORMS OF LEAVES AND OF COTYLEDONS.

Introduction: Forms of Leaves.

I HAVE elsewhere * called attention to the forms of Leaves, and discussed the causes to which we might ascribe the endless differences which they assume. Vertical leaves, for instance, are generally long and narrow, horizontal ones have a tendency towards width, which brings the centre of gravity nearer to the point of support. Wide leaves, again, are sometimes heart-shaped, sometimes lobed. The former shape is obviously that which would arise if a leaf is gradually widened at the base; and I have pointed out that in many species with lobed leaves—for instance *Passiflora*, *Cephalandra*, *Hibiscus*, &c.—the first, or few first, leaves are entire and more or less cordate. The cordate form, then, appears to be the early, the palmate a later form. But what advantage does the palmate form present?

Now in cordate leaves with veins following the curvature of the leaf, as, for instance, in *Tamus* (fig. 1, p. 342), the vascular bundles pursue necessarily a curved course; while in palmate leaves, as in *Acer* (fig. 2), the veins are straight; and it is clearly an advantage that the main channels which convey the nutritive fluid should hold a direct course. In such cases the leaf naturally assumes the lobed form with a vein running to the point of each lobe. There has indeed been some question whether the path of the sap lies mainly in the cell-walls or in the cell-cavities; but the evidence seems to point strongly to the latter view †. The tracheids of, say, the Yew "are at least seventy or eighty times as long as they are broad, so that in travelling transversely the length of a single tracheid the water-current has to traverse seventy cell-walls instead of one" ‡.

In reply, then, to the question why some plants should have cordate leaves with curved veins, while others have palmate

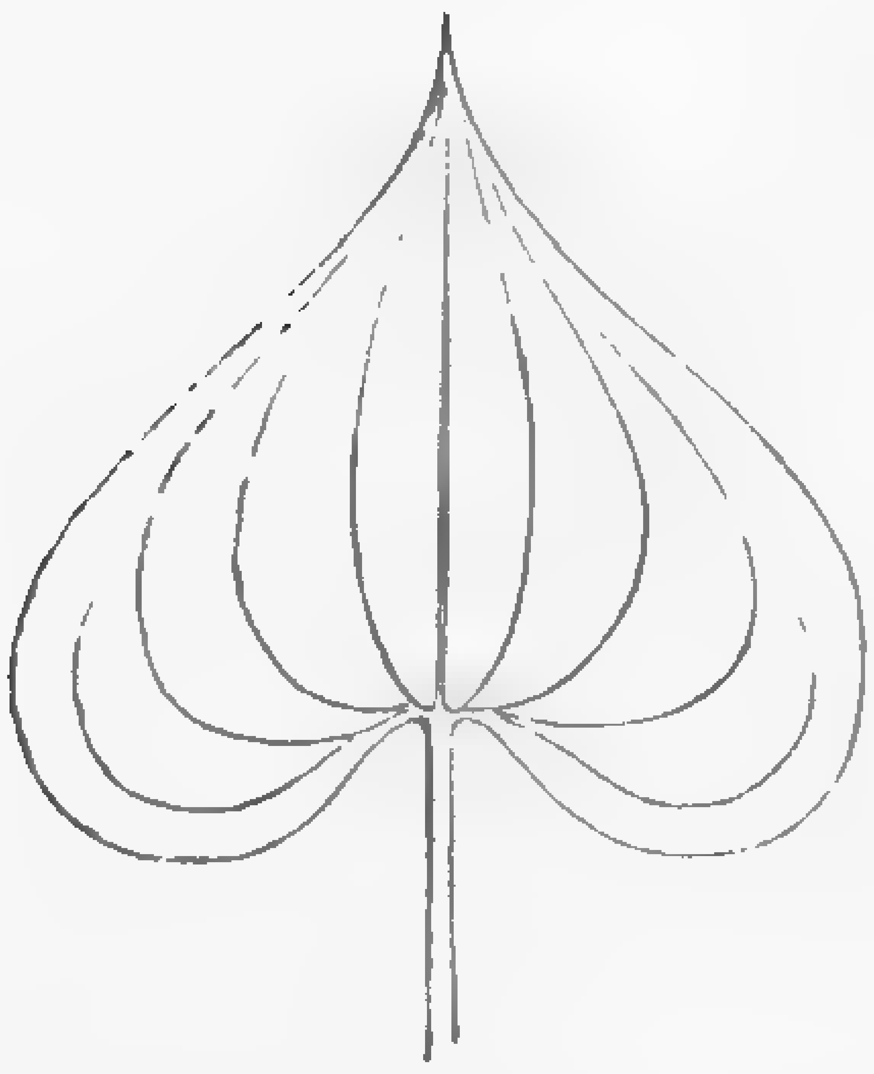
* Journal Royal Institution, 1885; 'Contemporary Review,' 1885; and 'Nature Series—Flowers, Fruits, and Leaves.'

† See, for instance, Darwin and Phillips, "On the Transpiration Stream in Cut Branches," Proc. Cambridge Phil. Soc. vol. v.

‡ *Loc. cit.* p. 364.

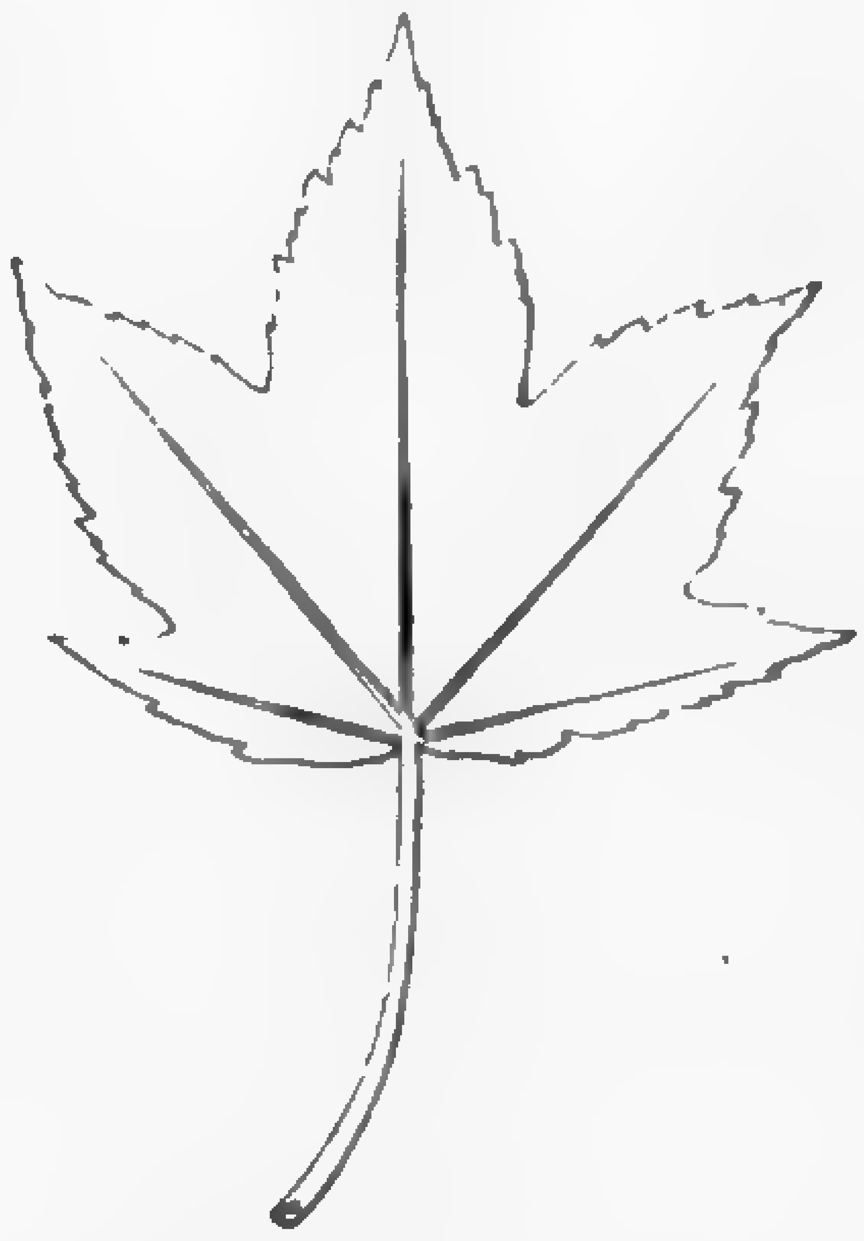
leaves with straight ones, I suggested that the first retains the old form of leaf, while the latter has assumed one which presents certain advantages.

Fig. 1.



Leaf of *Tamus*, to show the curved course of the veins.

Fig. 2.



Leaf of Sycamore, to show the straight course of the veins.

I also pointed out that in many cases the form of the leaf was determined by the distance between the buds taken in connection with the strength of the stem, and illustrated this by numerous examples. For instance, the Spanish Chestnut has a stronger stem than the Beech, but the distances between the buds are not much greater; consequently the leaves may be much larger, but cannot be much broader; hence they assume the dagger-like form characteristic of that species. Again, in Conifers, the species with short leaves generally retain their leaves for several years, those with longer ones for a shorter period; the length of the leaf seeming to be a function of the strength of the shoot, taken in relation to the longevity of the leaf. The vast majority, indeed, of Conifers are evergreens, though some few, such as the Larch (*Larix*), are deciduous. This species flourishes especially in Siberia and the higher alpine slopes of Switzerland, while elsewhere the Spruce gains the upper hand. These two species are deadly enemies. Generally the Spruce has the advantage, as the young Spruce will grow under Larch, while the shade of the Spruce is fatal to most other plants. But in Siberia and in the upper Alpine slopes of Switzerland the short summer is perhaps too short for the Spruce, while giving sufficient time for the Larch.

It has been suggested by Mr. Grant Allen that the tendency to division in subaqueous leaves is due to the comparative paucity of carbonic acid in water as compared with air. I have ventured to suggest a different explanation. Of course it is important to

expose as large a surface as may be to the action of the water. We know that the gills of fish consist of a number of thin plates, which, while in water, float apart, but have not sufficient consistence to support even their own weight, much less any external force, and consequently collapse in air. The same thing happens with thin, finely-cut leaves. In still water they afford the greatest possible extent of surface with the least expenditure of effort in the formation of skeleton. This is, I believe, the explanation of the prevalence of this form in subaqueous leaves, as, for instance, in *Myriophyllum*, *Hottonia*, *Utricularia*, *Ranunculus*, and many others.

Again, in still air, the conditions, except so far as they are modified by the weight, would approximate to those of water; but the more the plant is exposed to wind the more would it require strengthening. Hence, perhaps, the fact that herbs so much oftener have finely-cut leaves than is the case with trees. In the Umbellifers, for instance, almost all the species have the leaves much divided, more, I need hardly say, than is the case with trees. Shrubs and trees are characterized by more or less entire leaves, such as those of the Laurel, Beech, Hornbeam, Lime; or by similarly-shaped leaflets, as in the Ash, Horse-chestnut, and Walnut.

There are, however, many groups of plants which, while habitually herbaceous, contain some shrubby species, or *vice versâ*. Let us take some groups of this description, in which the herbaceous species have their leaves much cut up, and see what is the character of the foliage in the shrubby species.

The vast majority of Umbellifers, as I have just observed, are herbaceous and with leaves much divided, the common Carrot being a typical example. One European species, however (*Bupleurum fruticosum*), is a shrub attaining a height of more than 6 feet, and has the leaves coriaceous and oblong-lanceolate.

Most of our common Groundsels (*Senecio*), again, are low herbs with much-cut leaves. Some species of *Senecio*, however, are shrubby, and their leaves assume a totally different character—*Senecio laurifolius* and *S. populifolius* having, as their specific names denote, leaves respectively resembling the Laurel and Poplar. In the genus *Oxalis*, again, there is a shrubby species—*O. Laureola*, with leaves like those of a Laurel.

I would venture, then, to suggest that this throws light on the reason why herbaceous plants so often have their leaves cut up.

On Seedlings.

The consideration of leaves naturally led to that of Cotyledons. I had already paid some attention to the form and structure of Seeds, on which I had the honour of addressing the Royal Institution in a lecture which appeared in its 'Journal,' and which I have since republished in the small volume already referred to.

I have since made a further study of Seeds and Seedlings, with special reference to the characteristics presented by the cotyledons and the first leaves. In this I have been greatly aided by the kindness with which the immense resources of Kew have been placed at my disposal, and for which my grateful thanks are due to Sir Joseph Hooker, Mr. Thiselton Dyer, Mr. Watson, and indeed the whole staff. I have also been permitted to make use of the Laboratory for which Science is indebted to the liberality of the late Mr. Jodrell. Mr. Carruthers and the other officers of the British Museum have kindly aided me in various ways; Mr. Lynch has sent me some seeds from the Botanic Garden at Cambridge; and Mr. Hanbury has been good enough to supply me with several seeds from his rich garden on the Riviera.

No one who has ever looked at seedlings can fail to have been struck by the contrast which the cotyledons afford, not only to the final leaves, but even to those by which they are immediately followed.

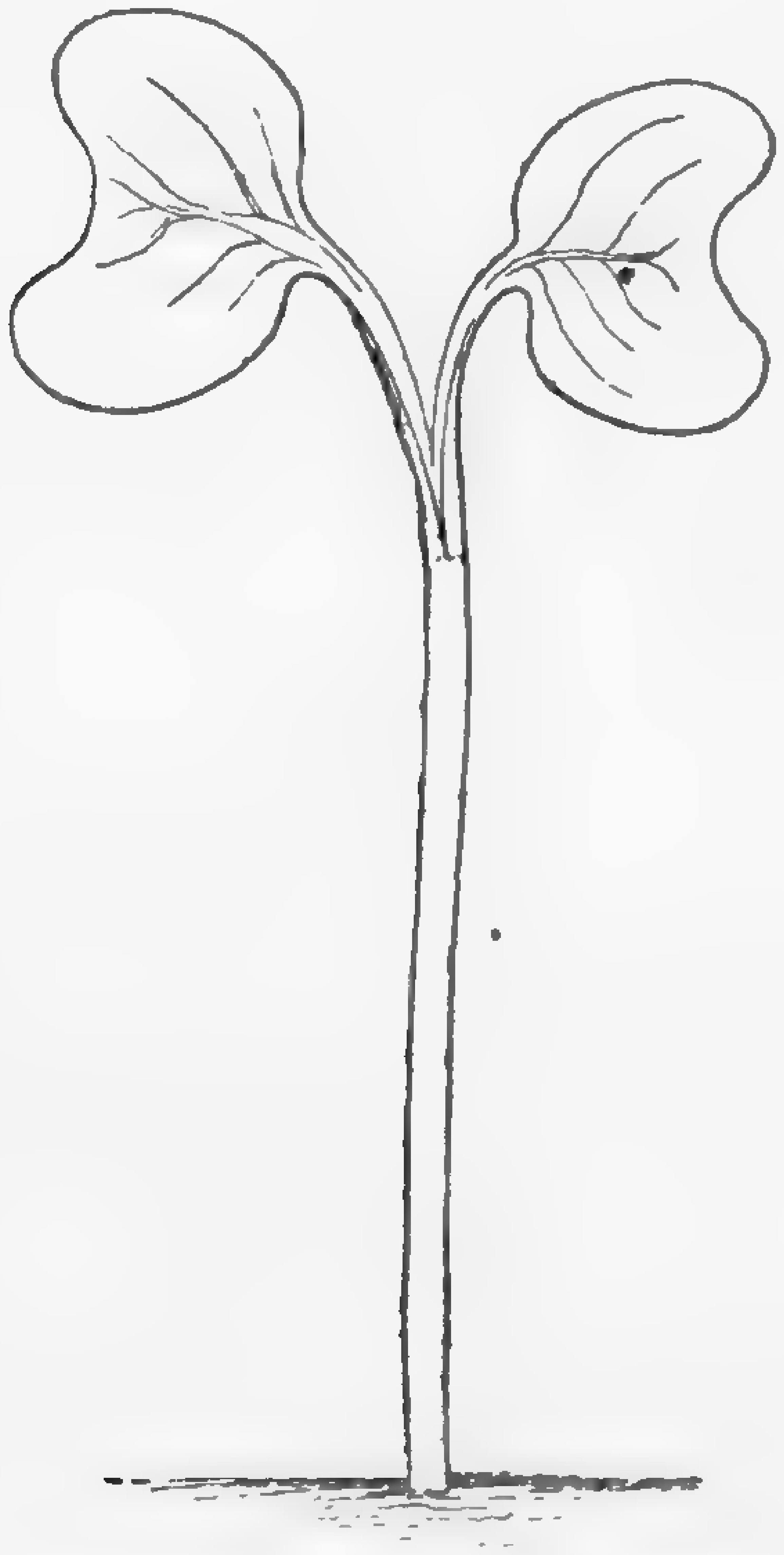
I propose to take certain plants (especially, as far as possible, the commonest and most familiar), and see what light can be thrown on the varied forms which their seedlings present. Look, for instance at the familiar Mustard and Cress; the first (fig. 3) has kidney-shaped cotyledons, one of them rather larger than the other; while the Cress, *Lepidium sativum* (fig. 4), on the other hand, has the cotyledons divided into three lobes. The Pink (*Dianthus*) has (fig. 22) broad cotyledons, the Chickweed and *Cerastium* (fig. 23) narrow ones; those of the Beech (fig. 13) are fan-shaped in outline; those of the Sycamore shaped almost like a knife; those of the *Eschscholtzia* (fig. 40) divided like a hay-fork; those of the Bean or Acorn thick and fleshy.

Mustard and Cress were the delight and wonder of our childhood; but at that time it never occurred, to me at least, to ask why they were formed as they are, and why they differed so much. So they grew, and beyond that it did not occur to me, nor I think to most, that it was possible to inquire.

I propose, however, to-day to suggest reasons which may account for some, at any rate, of these differences.

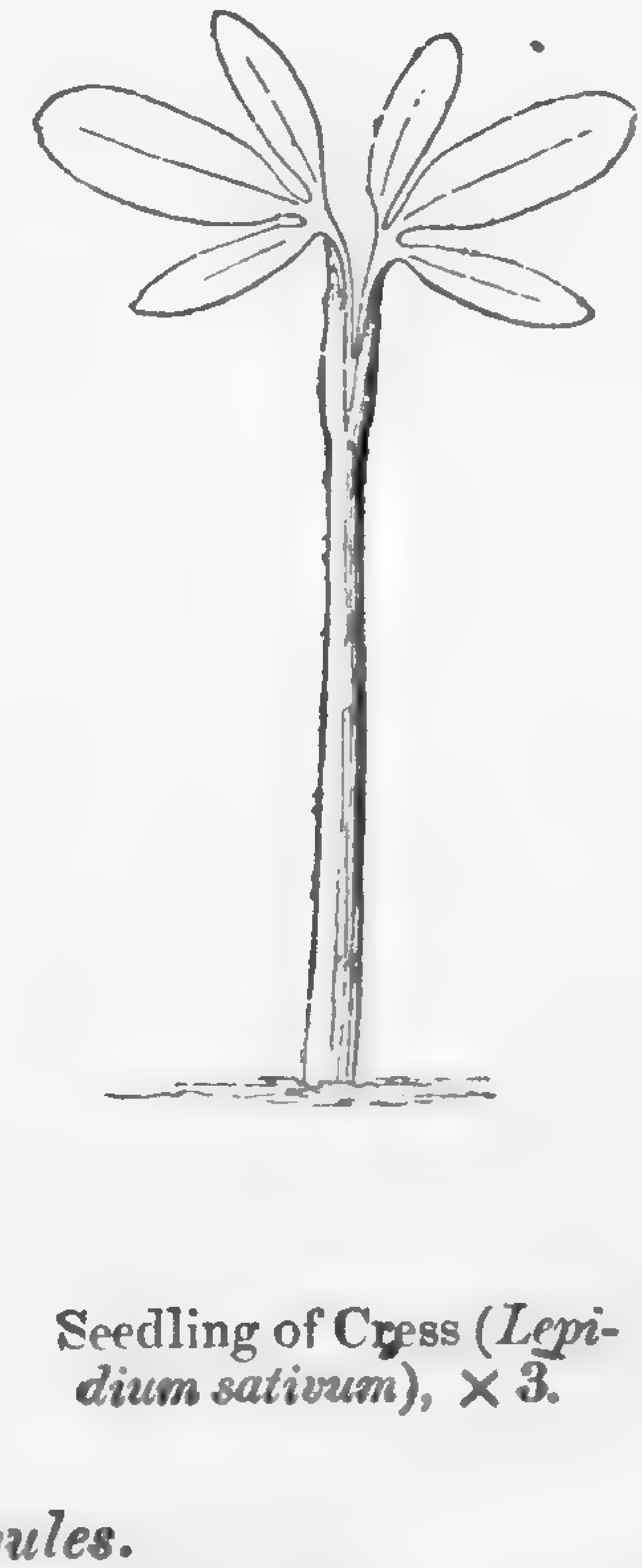
In the Memoirs to which I have already referred, I have discussed the causes which regulate the forms of seeds, and will not now therefore enter into them. I may just, however, observe that the shape of the cotyledons seems to have little, if any, influence on the form of the seed.

Fig. 3.



Seedling of Mustard (*Brassica nigra*), × 3.

Fig. 4.



Seedling of Cress (*Lepidium sativum*), × 3.

Forms of Ovules.

It may be convenient that I should shortly define a few technical terms which I shall have to use frequently. The *fruit* consists of the ovary and whatever other parts persist when the seed is ripe. The *seed* is the *ovule* fertilized by the pollen. The *testa* is the outer shell or coat of the seed. The *micropyle* is a small opening through which the pollen-tube obtains access to the interior of the ovule. The *funicle* is the stalk by which the seed is attached. The *hilum* is the scar left on the seed at the point where it was attached to the funicle. The *chalaza* is the spot to which the nutritive vessels reach before ramifying in the seed. In some seeds the chalaza and hilum coincide; when this is not

the case they are connected by the *raphe.* The *embryo* or young plant consists (1) of the *radicle* or base of the embryo, which gives origin to the root, (2) of one or two *cotyledons* or future seed-leaves, and (3) the *plumule*, or bud of the future stem between the cotyledons. It is embedded in *perisperm*, a mealy, oily, fleshy, or horn-like substance, which serves to nourish the young plant, but is in many cases entirely absorbed by the embryo by the time the seed is ripe.

If we take one of the simplest seeds in a very young state, say that of a Buckwheat or Nettle, we shall find that it is a small, upright, more or less pear-shaped body attached at the base, and with a small opening at the free end, which is called the "micropyle" or little doorway. Seeds thus formed are called "orthotropous" or straight. But this, though the simplest, is the least common form of seed. More often, as in the Bean, Chickweed, and many others, the ovule during its growth is curved on itself, so that the apex and the "micropyle" are brought down very near to the base. Such ovules are known as "campylotropous" or curved.

In a third category the seed itself is straight, but it stands as it were at right angles to the base of attachment. These are called "half anatropous" or half reversed.

Lastly, in a very large number of seeds—in fact by far the largest—the seed is quite inverted on its base; the funiculus, or stalk growing with the seed, forming a sort of ridge or "raphe" as it is technically called, which is very conspicuous in the ovule, but gradually becomes less and less apparent, and which completely reverses the seed. The "chalaza" or place of attachment of the seed itself, and from which the nutritive vessels ramify, is thus carried right away from the "hilum" or point of attachment to the opposite end, and the whole seed is reversed, so that the true base is removed from, and the true apex brought close to, the point of union with the ovary. Such seeds are called "anatropous" or reversed.

Now this seems a very curious and roundabout arrangement. It is described in all works on general Botany, but those which I have seen do not give any explanation of its object or purpose. I will for the moment omit any consideration of "campylotropous" and "half anatropous" seeds, and confine myself to orthotropous and anatropous forms.

In orthotropous species, as for instance in the Buckwheat, the

ovule is straight, upright, and attached by its base. At the free end is the "micropyle," and immediately below it, embedded in the seed, is a small group of special cells—the rudiment or embryo of the future plant. Now when the pollen falls on the stigma it soon begins to grow. It pushes out a little tube, which rapidly elongates, passes into the cavity of the ovary, enters the micropyle or little door, left open, and conveniently placed for it, and vivifies the rudiment of the future plant.

But ovaries thus constituted are, as I have already mentioned, quite exceptional. In a great many plants the seed, instead of being upright and rising at the base of the ovary, is, on the contrary, attached to the summit and pendent; and in still more the ovary contains a large number of seeds. Now in a pendent "orthotropous" ovule, the micropyle would be turned away from the pollen-tube; but the object and effect of the seed being reversed or "anatropous" is to bring the micropyle back into a convenient position. So also, when there are many ovules, the result of the anatropous arrangement is again to bring the micropyle into a suitable position.

The structure and arrangement of the ovule have been the subject of various important memoirs, which, however, have been almost exclusively descriptive. Dalmer* indeed quotes Schleiden, who, speaking of *Berberis*, pointed out that among the normal anatropous ovules here and there one occurs which is orthotropous, and that these never develop into seeds ("Die Befruchtung der Ovule scheint mir aber in ganz bestimmter Beziehung zu dem vorgeschriebenen Lauf der Pollenschläuche zu stehen, denn stets beobachtete ich, dass diese regelwidrige atropen Eichen unbefruchtet blieben"). The pollen-tubes, however, would naturally follow the regular course; and we could not, I think, deduce a general conclusion from such rare and abnormal cases. Dalmer himself does not seem to have done so; for, after referring to the different forms of seeds, he observes that "*sometimes* the form of the ovule appears to be adapted so as to facilitate the entrance of the pollen-tube" ("scheint zuweilen die Gestalt des Ovulums dem Eintritt des Pollenschlauches angepasst zu sein"). Even here, then, the explanation I venture to suggest seems referred to rather as an exceptional occurrence than as a general explanation of this remarkable

* "Ueber die Leitung der Pollenschläuche bei den Angiospermen," Jenaisch. Zeits. 1880, p. 530.

arrangement. It must be admitted that there are some cases in which the anatropy of the seed appears at first sight rather disadvantageous than otherwise. Most of these can, I believe, be explained, while in some it is possible that the plants retain, even perhaps to their present disadvantage, an arrangement inherited from an ancestral condition in which it was beneficial. I hope, however, to enter into this more fully on a future occasion.

When we cut open a seed, we find within it a more or less differentiated embryo; sometimes, as in the Ash (*Fraxinus*, fig. 48), or Castor Oil (*Ricinus*, fig. 54), &c., a lovely little miniature plant, generally white, but in some species green, distinctly formed, but still embedded in food-material or "perisperm." Such plants occupy an intermediate place between those in which, as for instance in the Larkspur (*Delphinium*, fig. 130), the embryo is very small, and those, on the other hand, where, as in *Hippophaë* (fig. 55), the perisperm is reduced almost to a film, or, as in the Bean, where the embryo occupies the whole seed, and the nourishment intended for the young plant is stored up in the cotyledons themselves.

In a Walnut, for instance, the two halves of the seed are the two cotyledons, and attached to them may be found the little plantlet with a delicate white root, and a little stalk bearing five or six minute rudiments of leaves, often just tipped with green.

I will now pass from seeds to seedlings. No one who has ever looked at young plants can fail to have been struck by the contrast they afford to the older specimens belonging to the same species. This arises partly from differences in the leaves, partly from the contrast which the cotyledons, or seed-leaves, afford, not only to the final leaves, but even to those by which they are immediately followed.

This contrast between the cotyledons and true leaves is so great that one might almost be pardoned for asking whether they can be brought into actual correlation, or whether the cotyledons, with the portion of stem belonging to them, might occupy some such relation to the rest of the plant as the prothallium does to the fronds of the Fern.

This, however, is not the direction in which we must look for the true explanation of the differences.

So far, indeed, are the cotyledons from agreeing with the forms of the leaves, that the difficulty is to find any which have been clearly influenced by them. One species of *Ipomœa* (*I. Pescapræ*) has both

cotyledons and leaves, as the name denotes, somewhat like the foot of a goat; but the leaves vary considerably, and it is probable that the resemblance may be accidental. A clear case is, however, afforded by the Onagrarieæ, where in *Œnothera* and some allied genera the form of the mature cotyledons is evidently related to the leaves, as I hope to show in a subsequent communication. Even here, however, the resemblance is confined to a basal portion of the cotyledon which makes its appearance subsequent to germination, and no trace of it is shown in the cotyledons themselves when they first appear.

The forms of the cotyledons in many species have been the subject of special memoirs by Tittmann, Irmisch, Wichura, Winkler, Tscherning, and other botanists; but they have not given any reasons for the various forms assumed.

Klebs, indeed, in his interesting Memoir on Germination *, refers to this diversity of form, and expressly says that these differences are an enigma ("Sind gewiss diese Verschiedenheiten in den Blattformen hinsichtlich ihrer biologischen Bedeutung für die Pflanze ein Räthsel"). He observes, however, that on the whole the forms of cotyledons are much simpler than those of leaves, and he suggests that while in some cases, perhaps like the first leaves, they retain the form which characterized the species in bygone ages, we may rather, as a more generally applicable explanation, apply to them the suggestion of Goebel with reference to stipules, and regard them as simplified by arrest † ("Ihre einfache Form einer ähnlichen Hemmung verdanken, welche vielleicht überwunden wird, wenn es gelingt, die Kotyledonen längere Zeit als Hauptassimilationsorgane bei jungen Pflanzen zu erhalten"). Even, however, if this suggestion were the real explanation of the comparative simplicity, it would throw no light on the differences between the cotyledons of different species.

Though cotyledons do not present nearly such extensive variations as leaves, still they do differ considerably from one another.

Forms of Cotyledons.

Some are narrow, in illustration of which I may mention *Fœniculum* (fig. 5), *Coreopsis* (fig. 6), *Ceratocephalus* (fig. 7), and *Ferula* (in the hollow stalk, or ferule, of which Prometheus

* "Beiträge zur Morphologie und Biologie der Keimung," Untersuch. Botan. Inst. v. Tübingen, 1884.

† *Loc. cit.* p. 613.

brought down fire from heaven), &c., where the ultimate leaves are much divided; *Platanus* (fig. 8) and *Acer* (fig. 9), where the ultimate leaves are palmate; and *Chenopodium* (fig. 10), where they are more or less triangular.

Fig. 5.

Fig. 6.

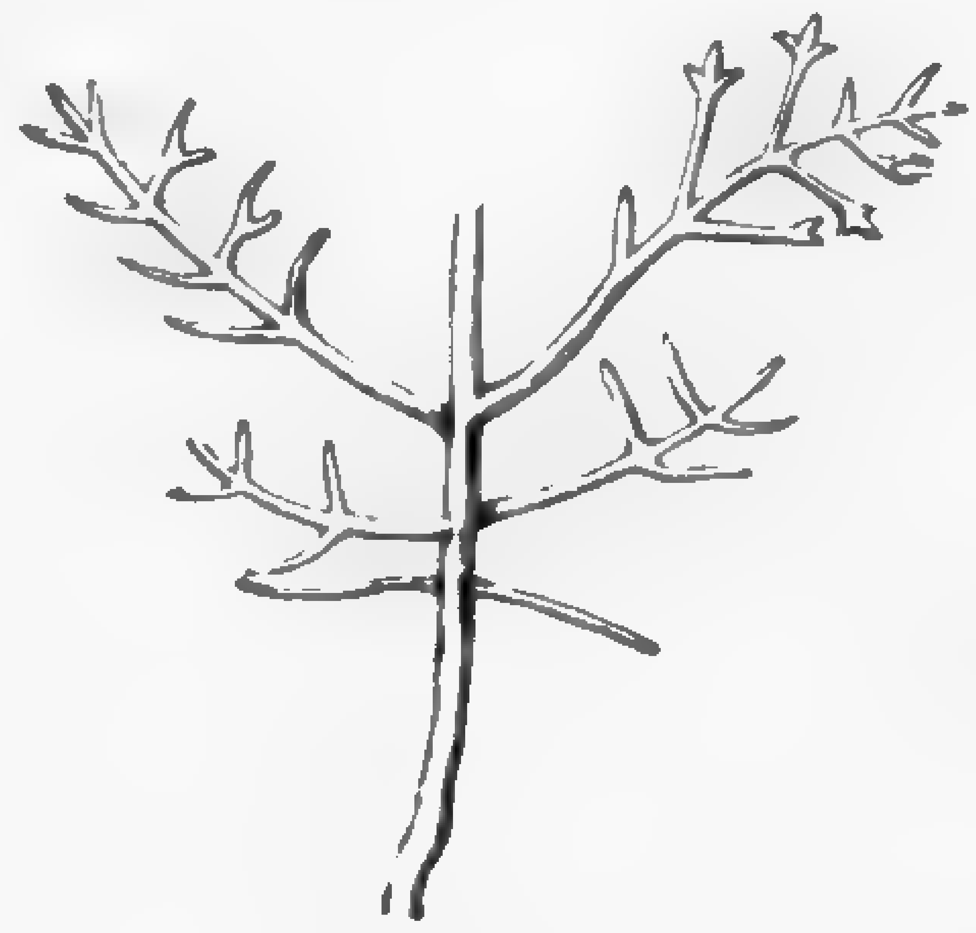


Fig. 7.

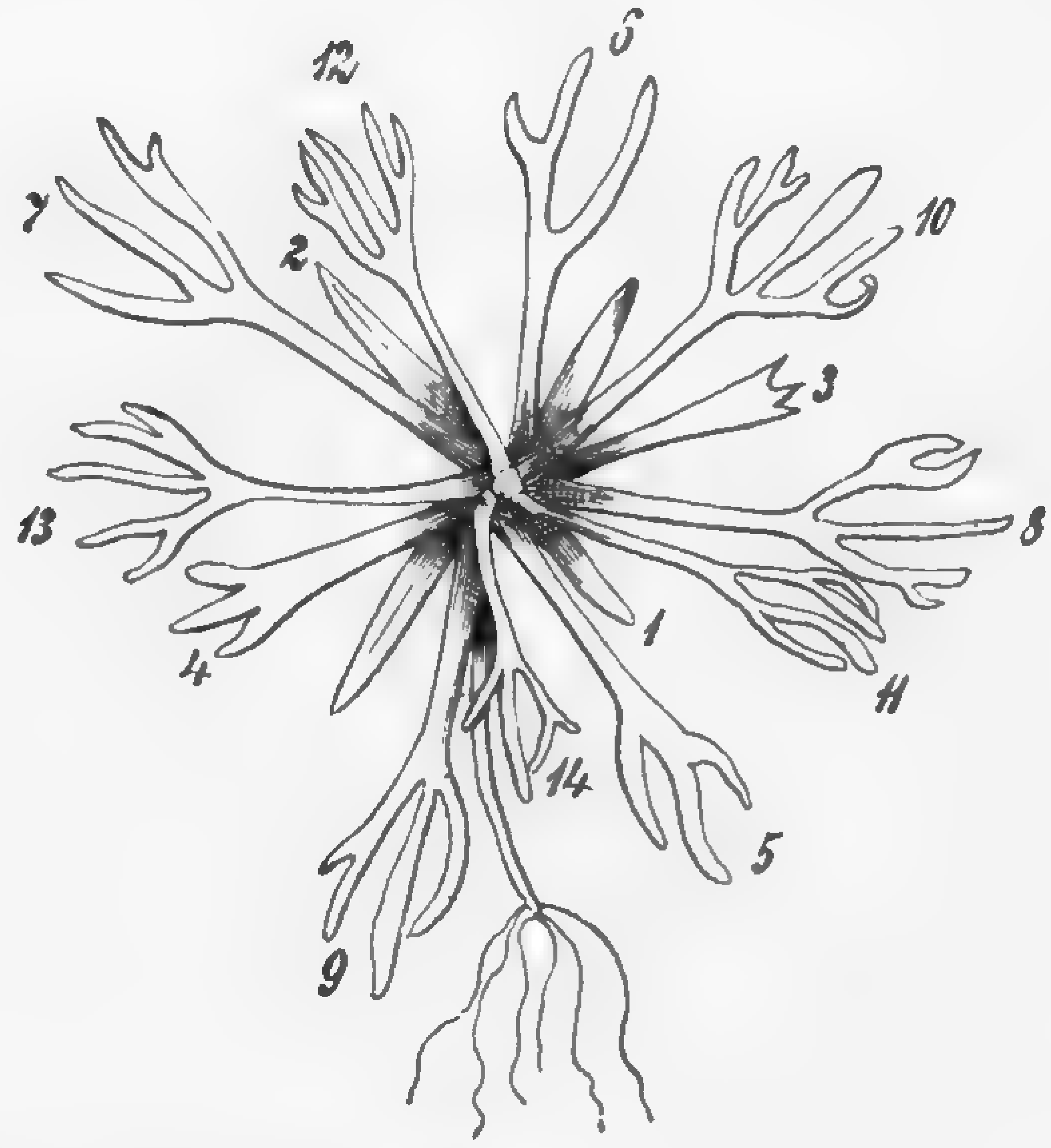


Fig. 5. Seedling of *Fœniculum vulgare*. Half nat. size.
Fig. 6. Seedling of *Coreopsis filifolia*. Half nat. size.
Fig. 7. Seedling of *Ceratocephalus falcatus*. Nat. size. The numerals indicate the successive leaves.

Some cotyledons are broad, in illustration of which I give figures of *Ricinus* (fig. 11), *Impatiens* (fig. 12), Beech (*Fagus*) (fig. 13), *Brassica* (fig. 3), *Hippophaë* (fig. 14), *Rivina* (fig. 15), *Ruellia* * (fig. 16), *Rhus typhina* (fig. 17), and Flax (*Linum*) (fig. 19). We find some species with narrow cotyledons and broad leaves, as *Menispermum* (fig. 18) and *Olea cuspidata* (fig. 20);

* In *Asystasia coromandeliana* there is an interesting peculiarity. The first pair of leaves of each branch, or at any rate of the lower branches, approximate to the form of the cotyledons.

Fig. 8.

Seedling of *Platanus*.
Nat. size.

Fig. 9.

Seedling of *Acer Pseudo-Platanus*.
Half nat. size.

Fig. 10.

Seedling of *Chenopodium Bonus-Henricus*. Nat. size.

Fig. 11.

Seedling of *Ricinus sanguineus*.
One fourth nat. size.

while in others the cotyledons are broad and the leaves narrow, as in Flax (*Linum monogynum*) (fig. 19), *Hakea* (fig. 21), and the Pink (*Dianthus*) (fig. 22), &c.

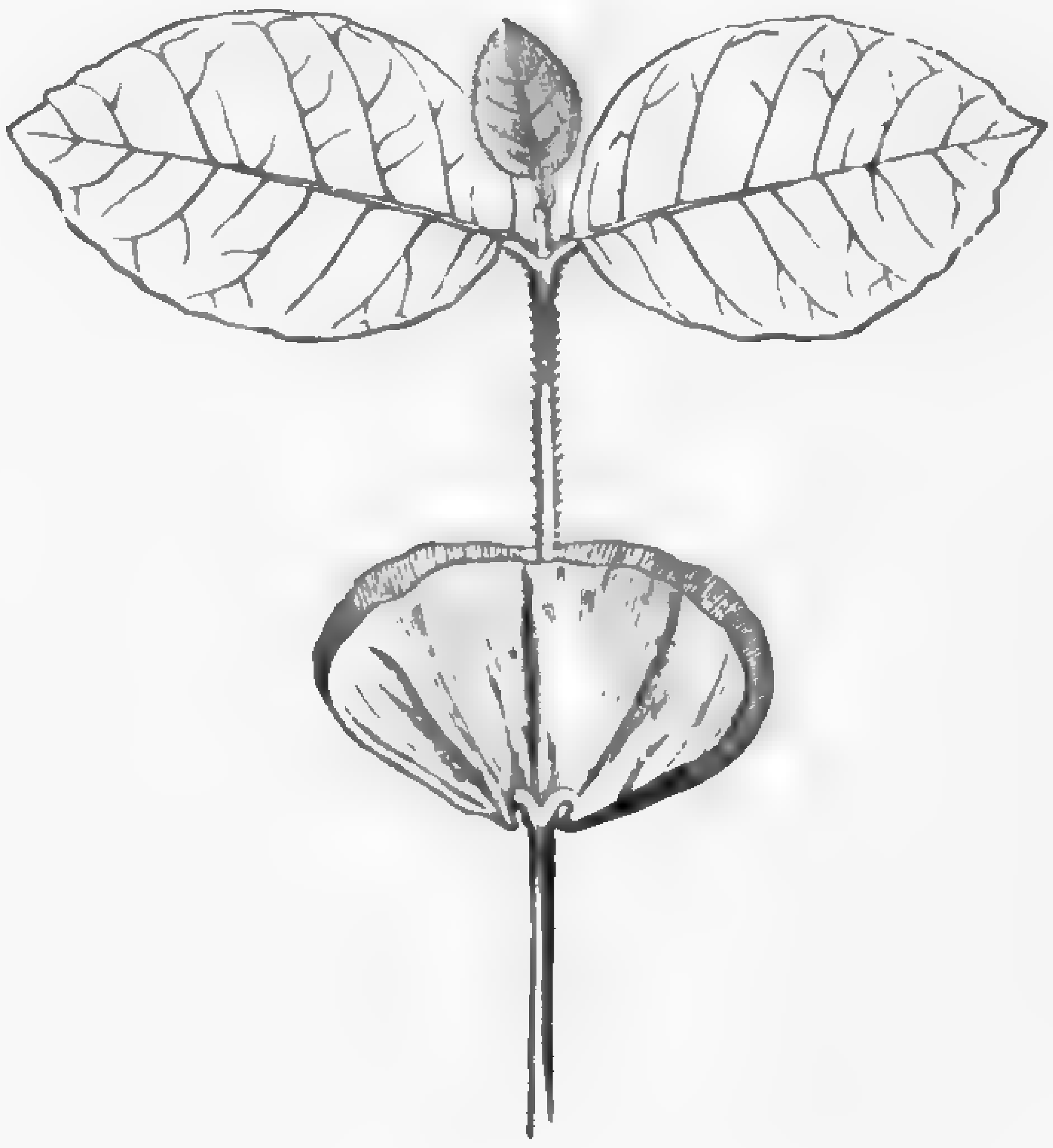
In many cases we find instances of broad and narrow cotyledons in the same family, as in Chickweed (fig. 23) and Pink (fig. 22), belonging to the Caryophyllaceæ; sometimes even in the same genus, as *Galium saccharatum* (fig. 24) and *Galium Aparine* (figs. 113 & 114).

In some cases the two cotyledons are unequal, as in the

Fig. 12.

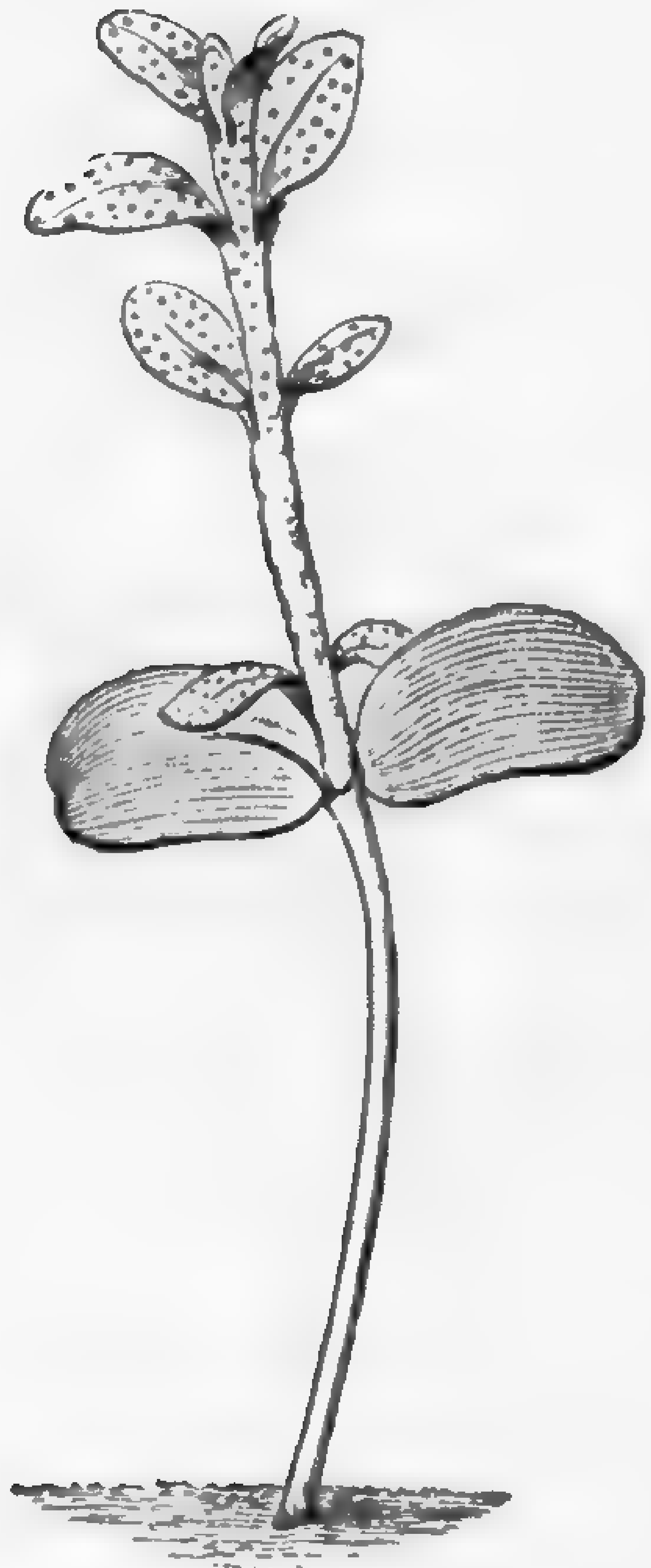
Seedling of *Impatiens Balsamina*.
Half nat. size.

Fig. 13.



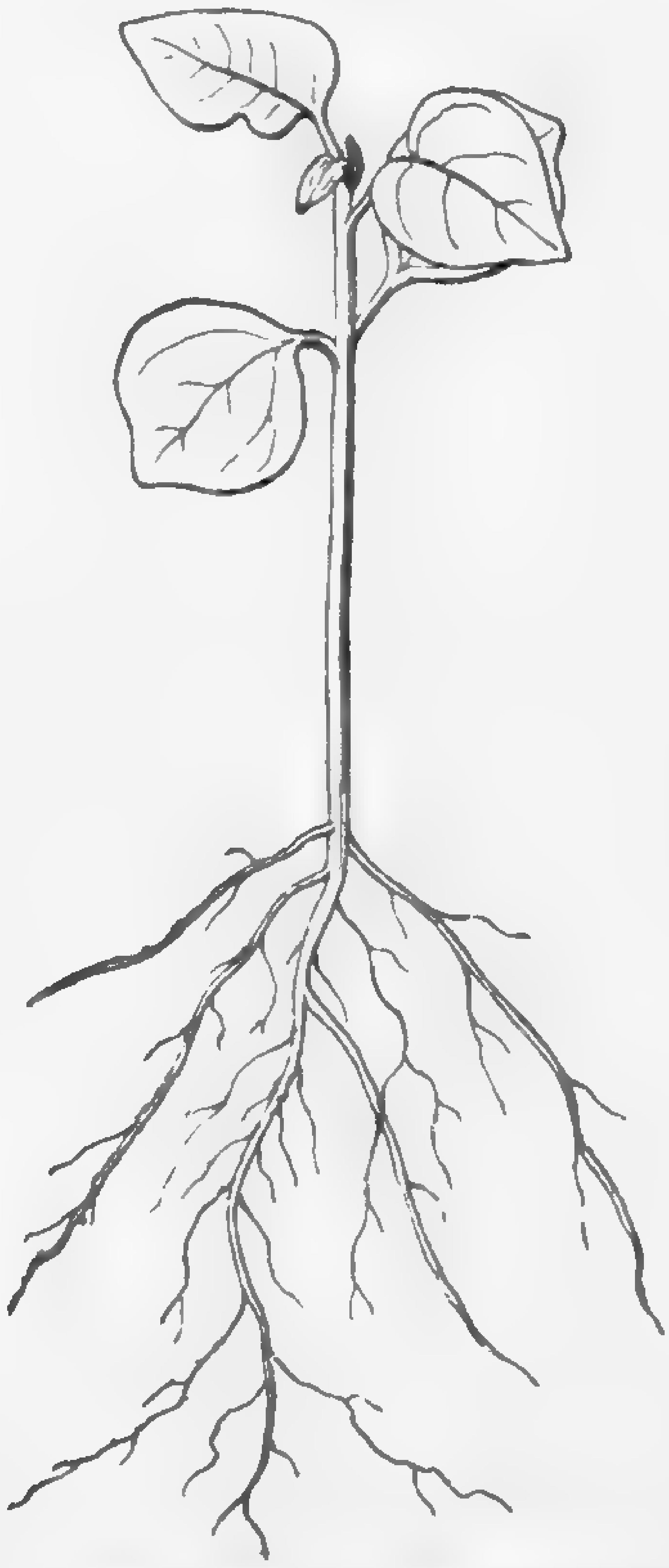
Seedling of Beech (*Fagus sylvatica*).
Half nat. size.

Fig. 14.



Seedling of *Hippophaë rhamnoides*.
Half nat. size.

Fig. 15.



Seedling of *Rivina lævis*.
Nat. size.

Fig. 16.

Seedling of *Ruellia flava*.
Half nat. size.

Fig. 17.

Seedling of *Rhus typhina*.
Half nat. size.

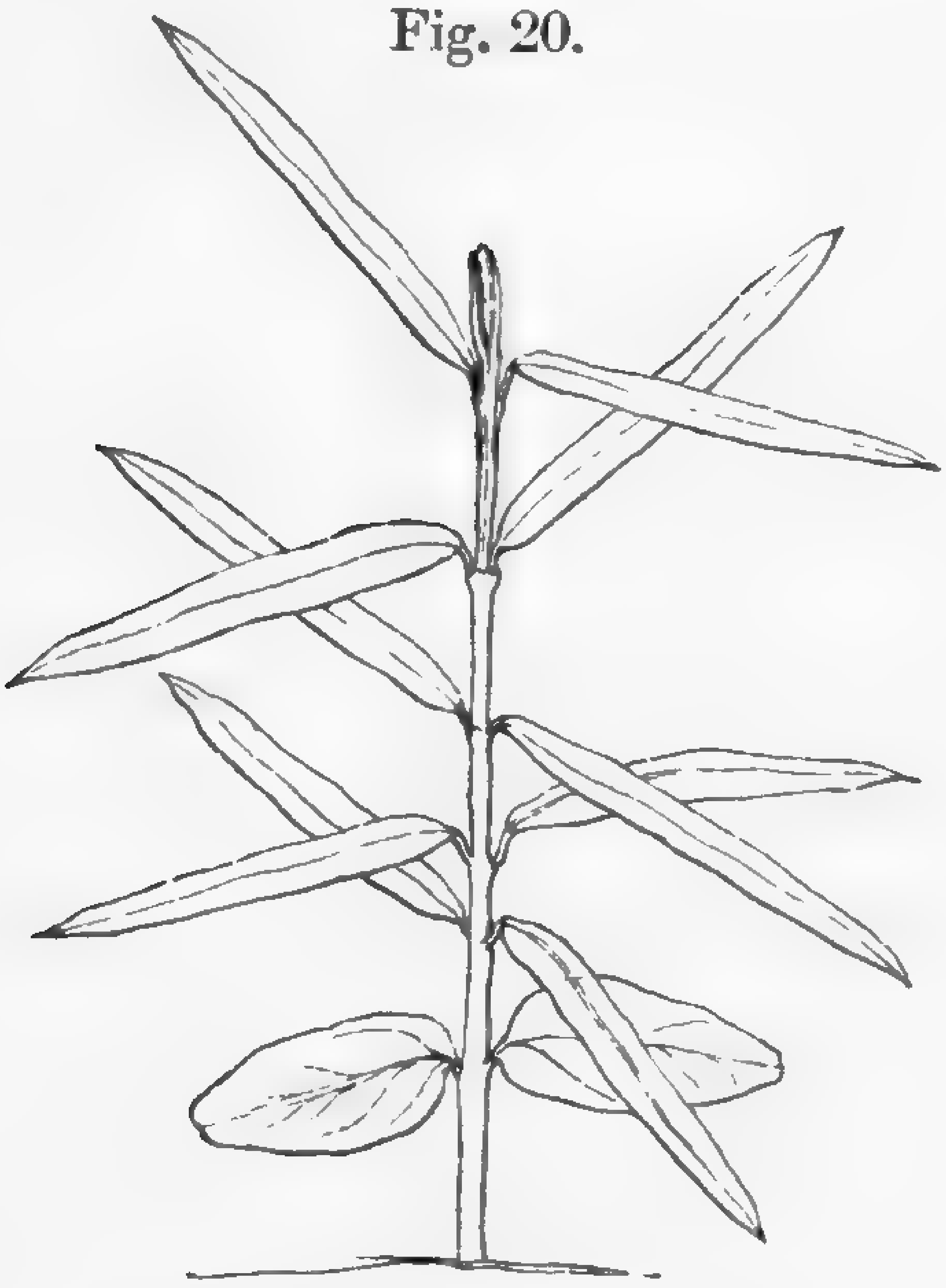
Fig. 18.

Seedling of *Menispermum canadense*.
Half nat. size.

Fig. 19.

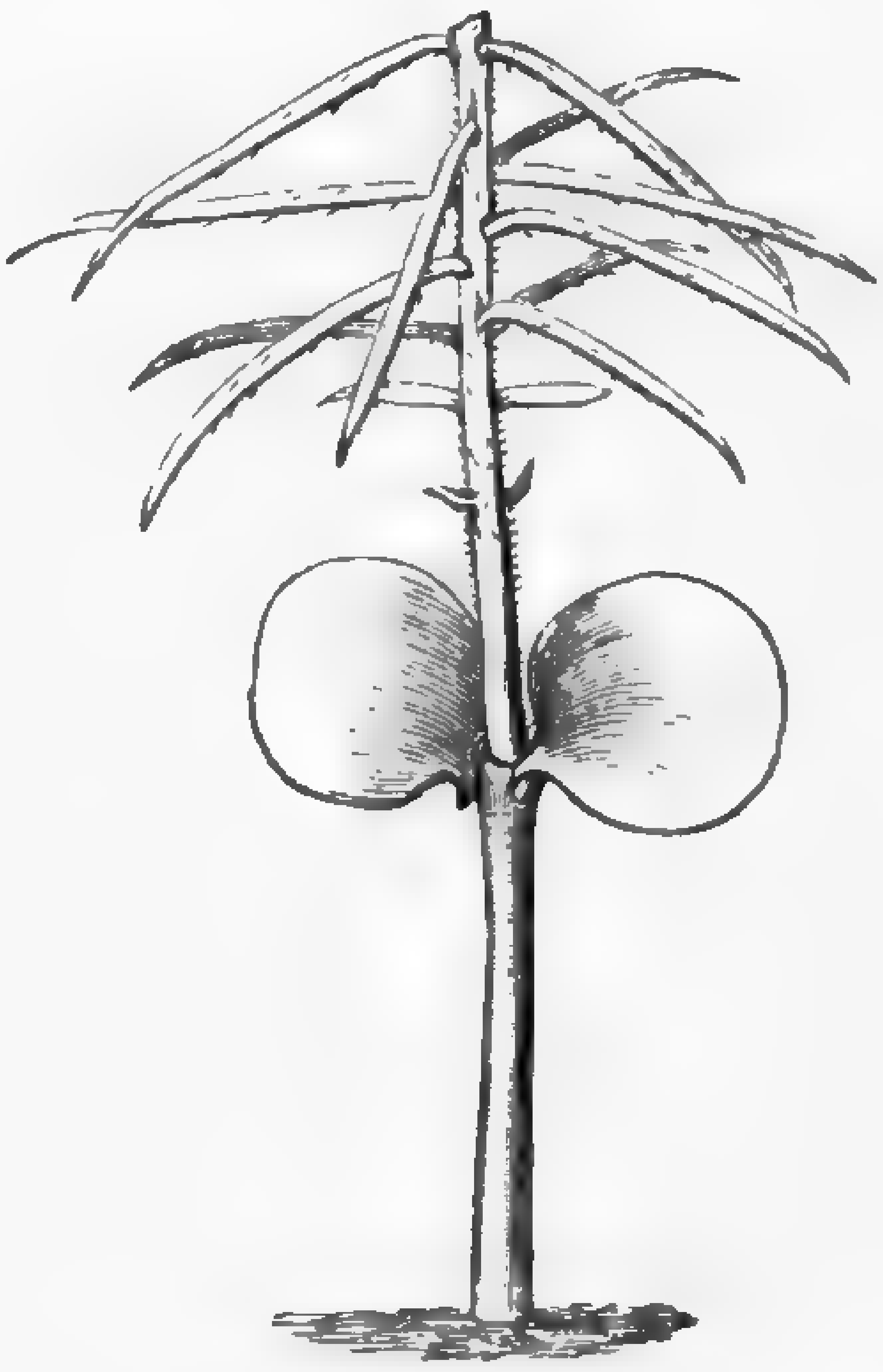
Seedling of Flax (*Linum monogynum*). Nat. size.

Fig. 20.



Seedling of *Olea cuspidata.*
Two thirds nat. size.

Fig. 21.



Seedling of *Hakea acicularis.*
Half nat. size.

Fig. 22.

Fig. 23.

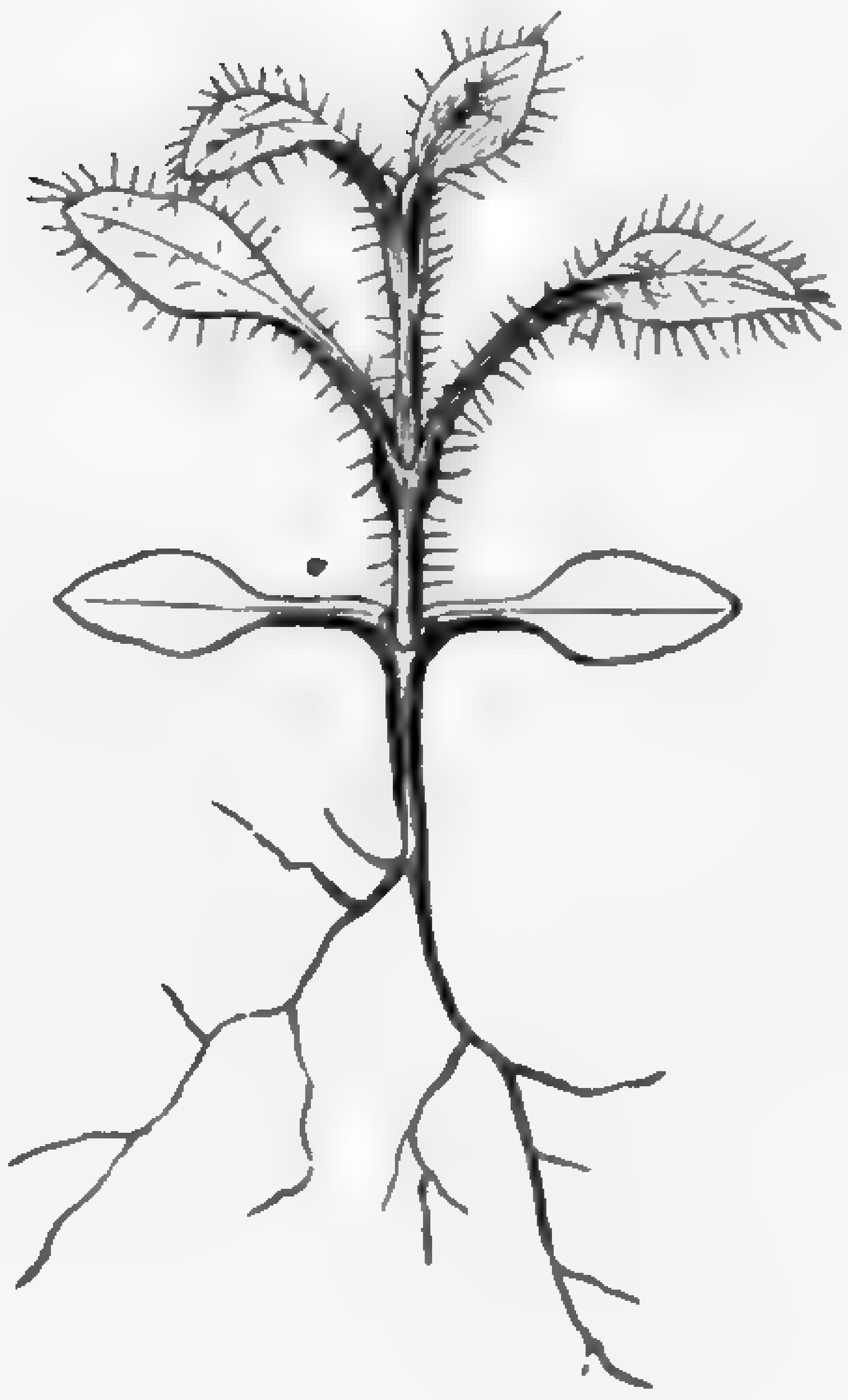
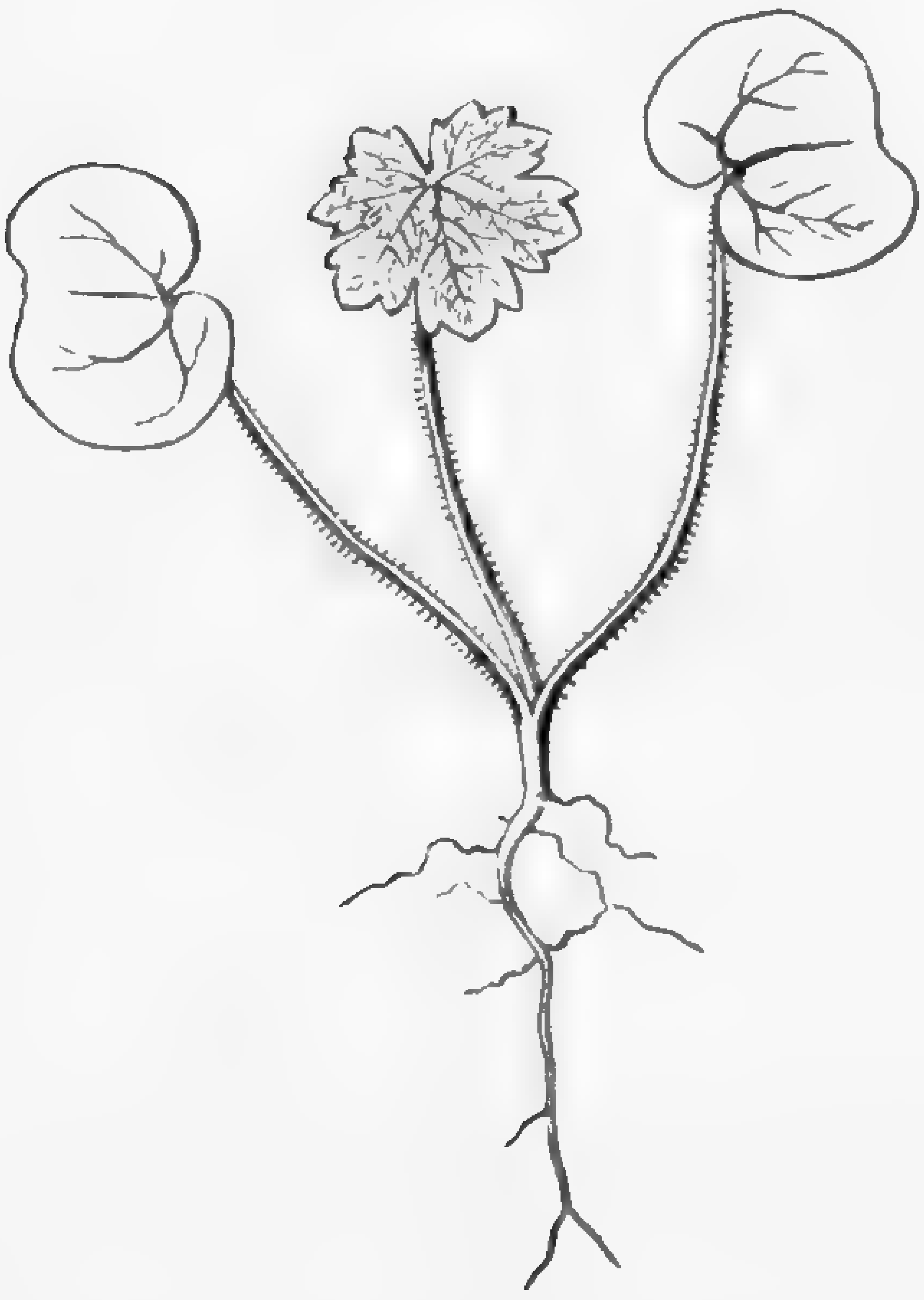


Fig. 24.

Fig. 22. Seedling of Pink (*Dianthus Caryophyllus*). Nat. size.
Fig. 23. Seedling of *Cerastium arvense.* Half nat. size.
Fig. 24. Seedling of *Galium saccharatum.* Nat. size.

Mustard (fig. 3), Cabbage, Radish, *Cereus* (fig. 79), *Pachira**, &c.: in some the two halves of each cotyledon are unequal, as in the Geraniums (fig. 25), or they are otherwise unsymmetrical, as in the Lupine, *Laburnum* (fig. 26), *Clitoria* (fig. 27), *Schinus* (fig. 28).

Fig. 25.



Seedling of *Geranium sanguineum*. Nat. size.

Fig. 26.

Seedling of Laburnum (*Cytisus vulgare*).[1] Nat. size.

Fig. 27.

Seedling of *Clitoria ternatea*. Half nat. size.

Fig. 28.

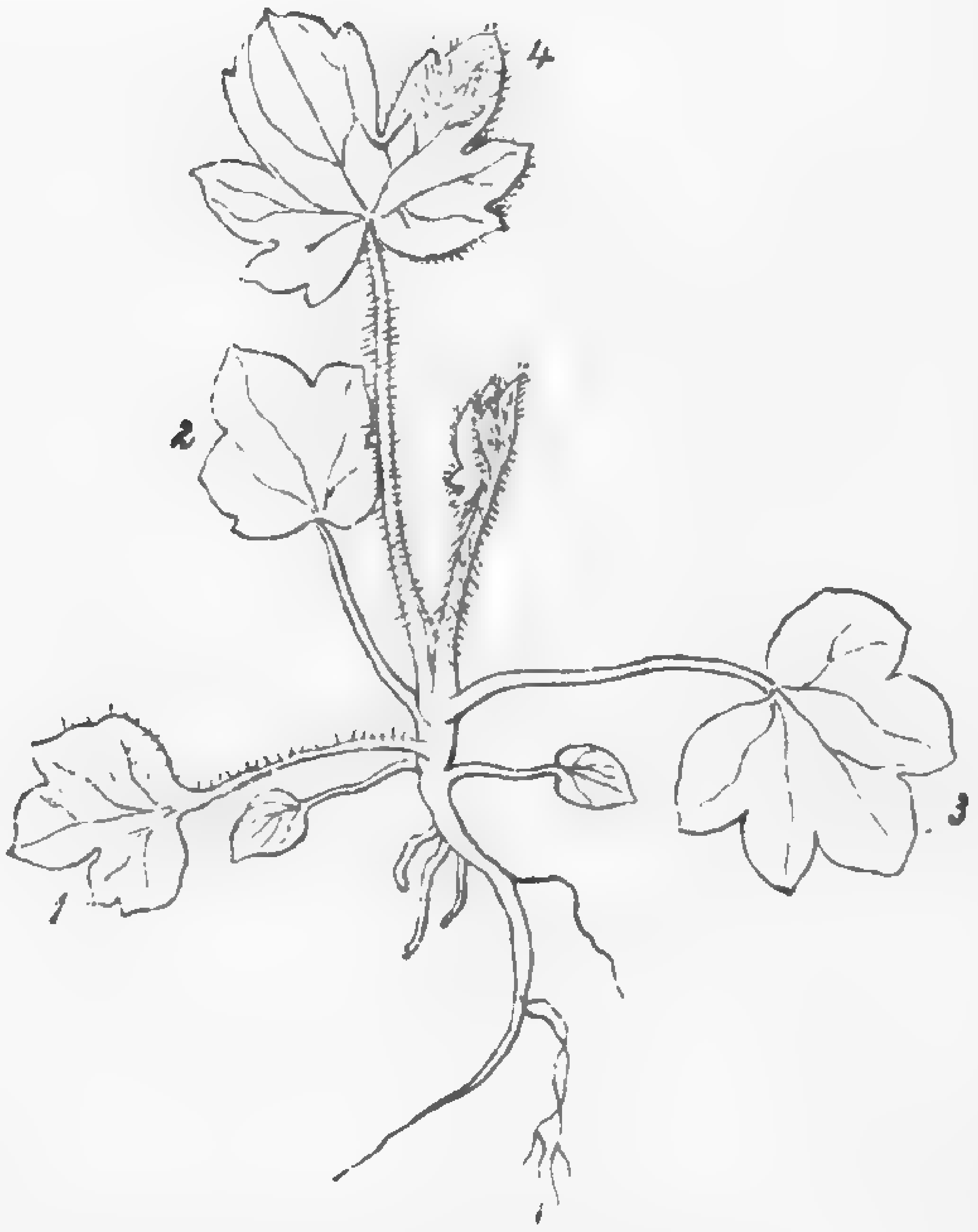
Seedling of *Schinus terebinthifolius*. Two thirds nat. size.

* As described by Mr. Lynch in our Journal, vol. xvii. p. 147.

Fig. 29.

Seedling of *Microloma*, ×1½.

Fig. 30.



Seedling of *Delphinium elatum*.
Two thirds nat. size.

Fig. 31.

Seedling of *Delphinium Staphisagria*.
Half nat. size.

Fig. 32.

Seedling of *Delphinium nudicaule*.
Half nat. size.

Sometimes they are sessile, as *Acer* (fig. 9), *Hakea* (fig. 21), *Laburnum* (fig. 26), &c.; sometimes they are supported on petioles, as in *Microloma* (fig. 29), which again are occasionally connate. These differences sometimes occur in very closely allied species; for instance in *Delphinium Staphisagria* (fig. 31) the cotyledons are sessile, while in *D. elatum* (fig. 30) they are petioled, and in *D. nudicaule* (fig. 32) the petioles are connate.

Generally the cotyledons are entire, but sometimes crenate, as in *Cordia* (fig. 33), or lobed, as in *Pelargonium* (fig. 34) and

Fig. 33.

Seedling of *Cordia subcordata*.
Half nat. size.

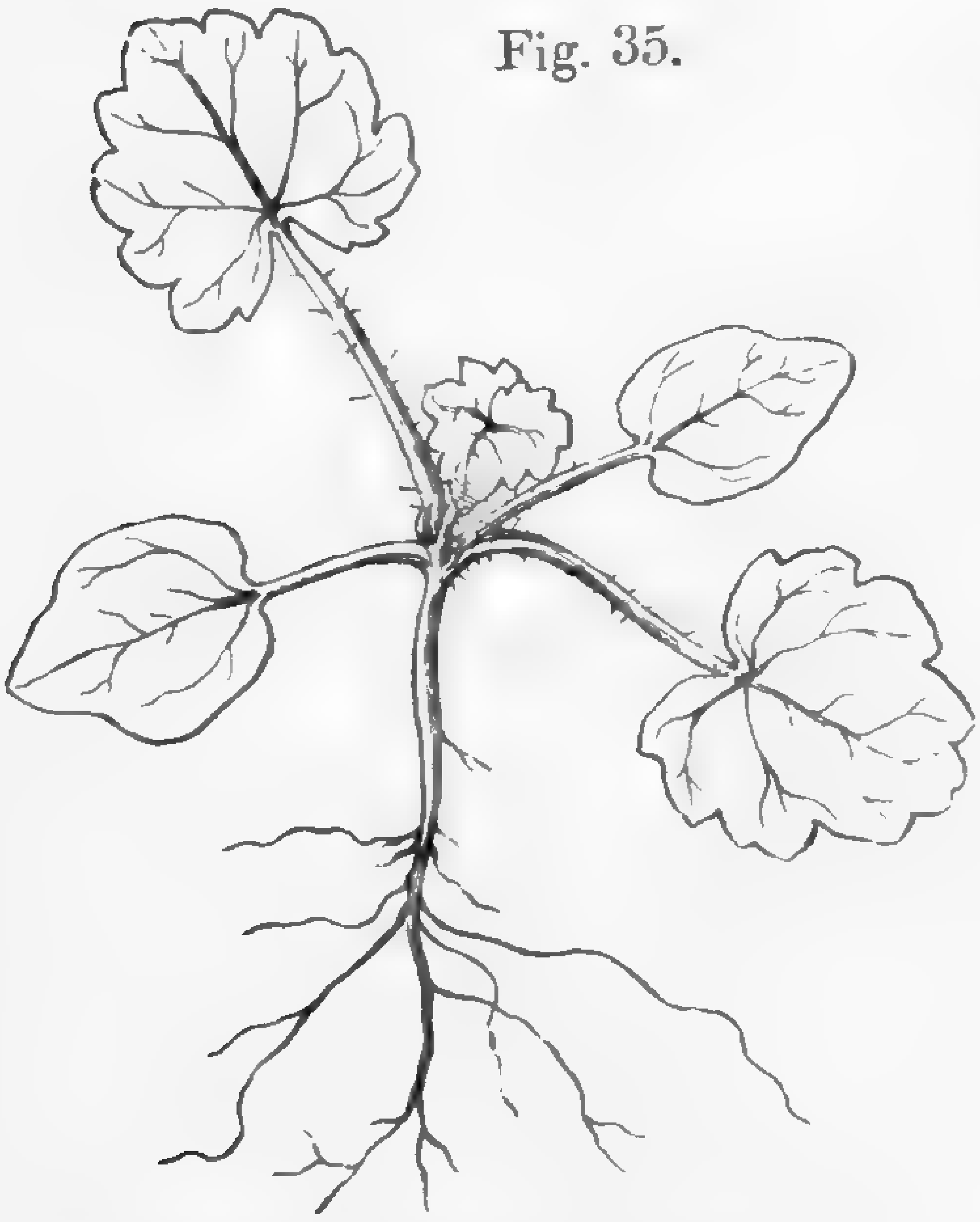
Fig. 34.

Seedling of *Pelargonium australe*.
Half nat. size.

Malva (fig. 35). Often they are emarginate, as in *Impatiens* (fig. 12), Mustard (fig. 3) and Cabbage, *Ipomæa* (fig. 106), *Convolvulus*, *Galium* (fig. 114), *Eucalyptus* (fig. 38), *Pentapetes* (fig. 39), &c. Nay, they are sometimes even bifid, as in *Eschscholtzia* (fig. 40) and *Ipomæa dasysperma* (fig. 111); trifid, as in the Cress (*Lepidium*, fig. 4), or in four long lobes, as in *Pterocarya* (fig. 41). Sometimes auricled at the base, as in *Poterium* (fig. 42) and *Cuphea*. Sometimes they are large; sometimes small. Generally they are leaf-like; but sometimes, as in *Rhus Thunbergii* (fig. 44), *Sapindus* (fig. 43), and among English plants in the Oak, Nut,

Peas, Bean, *Mercurialis perennis**, *Melittis melissophyllum*†, *Nymphæa*, *Nuphar*, *Rhamnus Frangula*, *Trientalis*, *Daphne*, &c., they are thick and fleshy.

Fig. 35.



Seedling of *Malva moschata*.
Nat. size.

Fig. 36.

Seedling of *Spathodea campanulata*.
Nat. size.

Fig. 37.

Seedling of *Catalpa Kæmpferi*.
Half nat. size.

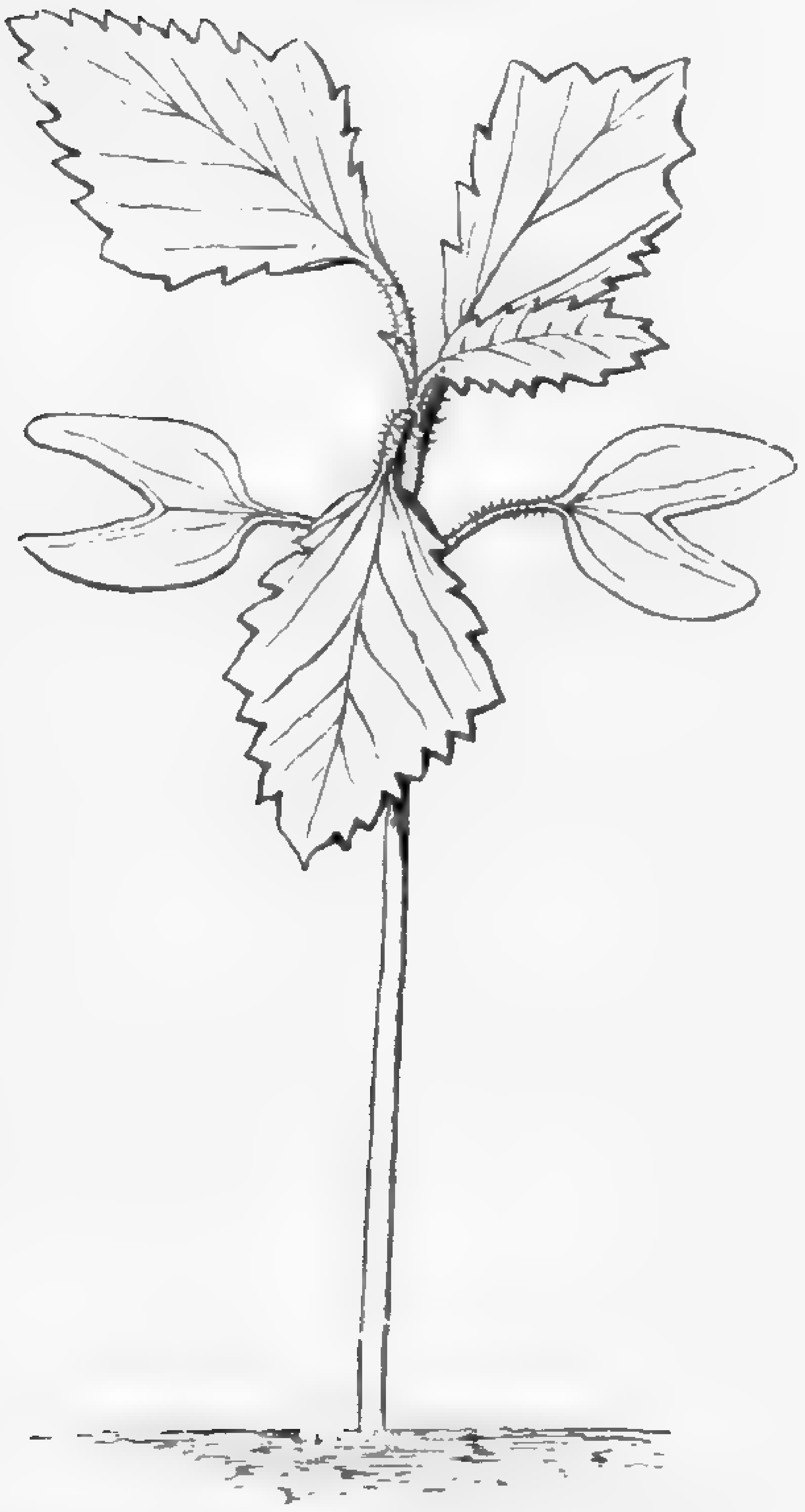
Fig. 38.

Seedling of *Eucalyptus*, sp.
Half nat. size.

* Winkler, "Ueber die Keimpflanze des *Mercurialis perennis*," Flora, 1880.

† Irmisch, "Zur Naturg. v. *Melittis*," Bot. Zeit. 1858, p. 283.

Fig. 39.



Seedling of *Pentapetes phœnicia.*
Nat. size.

Fig. 40.

Seedling of *Eschscholtzia californica.*
Nat. size.

Fig. 41.

Seedling of *Pterocarya caucasica.*
Nat. size.

Fig 42.

Seedling of *Poterium Sanguisorba.*
Twice nat. size.

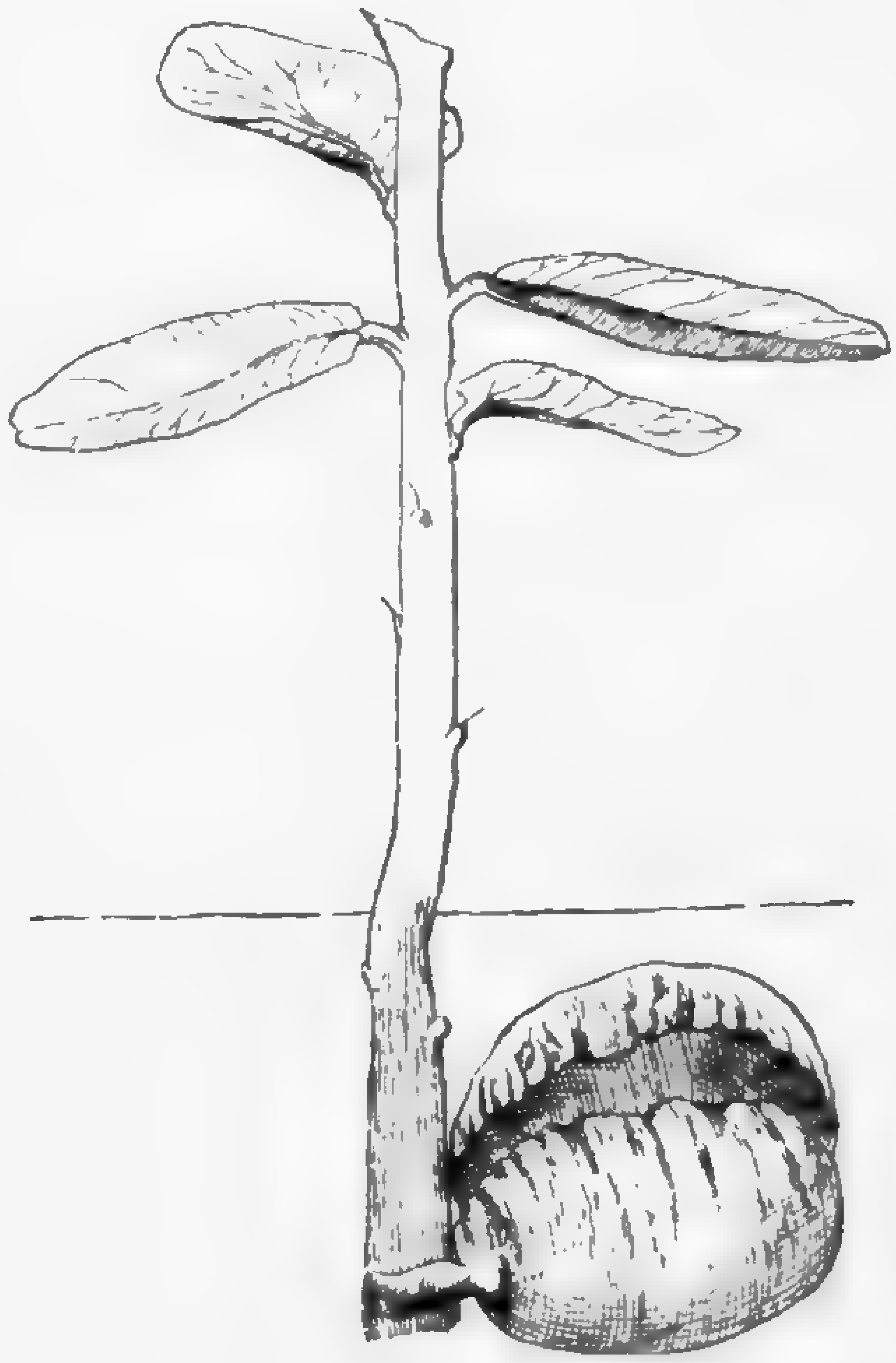
Narrow Cotyledons.

Let us now begin with such species as have narrow cotyledons, and see if we can throw any light on this characteristic. The

Fig. 43.

Seedling of *Sapindus inæqualis.* Half nat. size.

Fig. 44.



Seedling of *Rhus Thunbergii.* Half nat. size.

problem is simple enough in such cases as *Platanus*, where we have on the one hand narrow cotyledons (fig. 8) and on the other hand a long narrow seed (fig. 45, *p*) fully occupied by a straight embryo. Again, in the Ash (*Fraxinus*, fig. 46), *Ursinia* (fig. 47), &c., the cotyledons lie parallel to the longer axis of the seed, which is narrow and elongated. Such cases, however, are comparatively few; and there are a large number of species in which the seeds are broad and even orbicular, while yet the cotyledons are narrow, as for instance in *Chenopodium* (fig. 48) and *Menispermum* (fig. 49).

In these it will generally be found that the cotyledons lie transversely to the seed. In *Menispermum* (fig. 18) the fruit

Fig. 45.

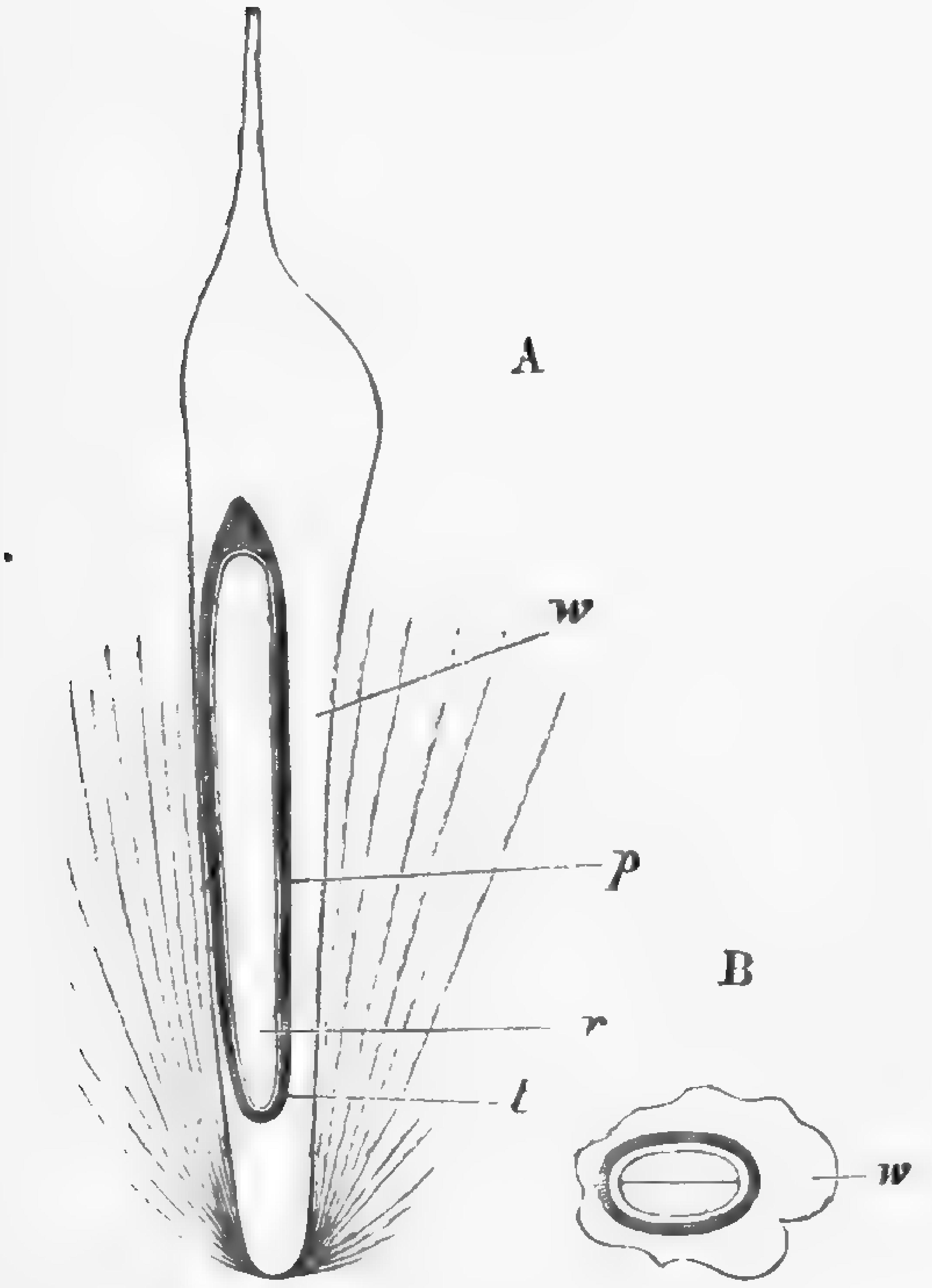


Fig. 46.

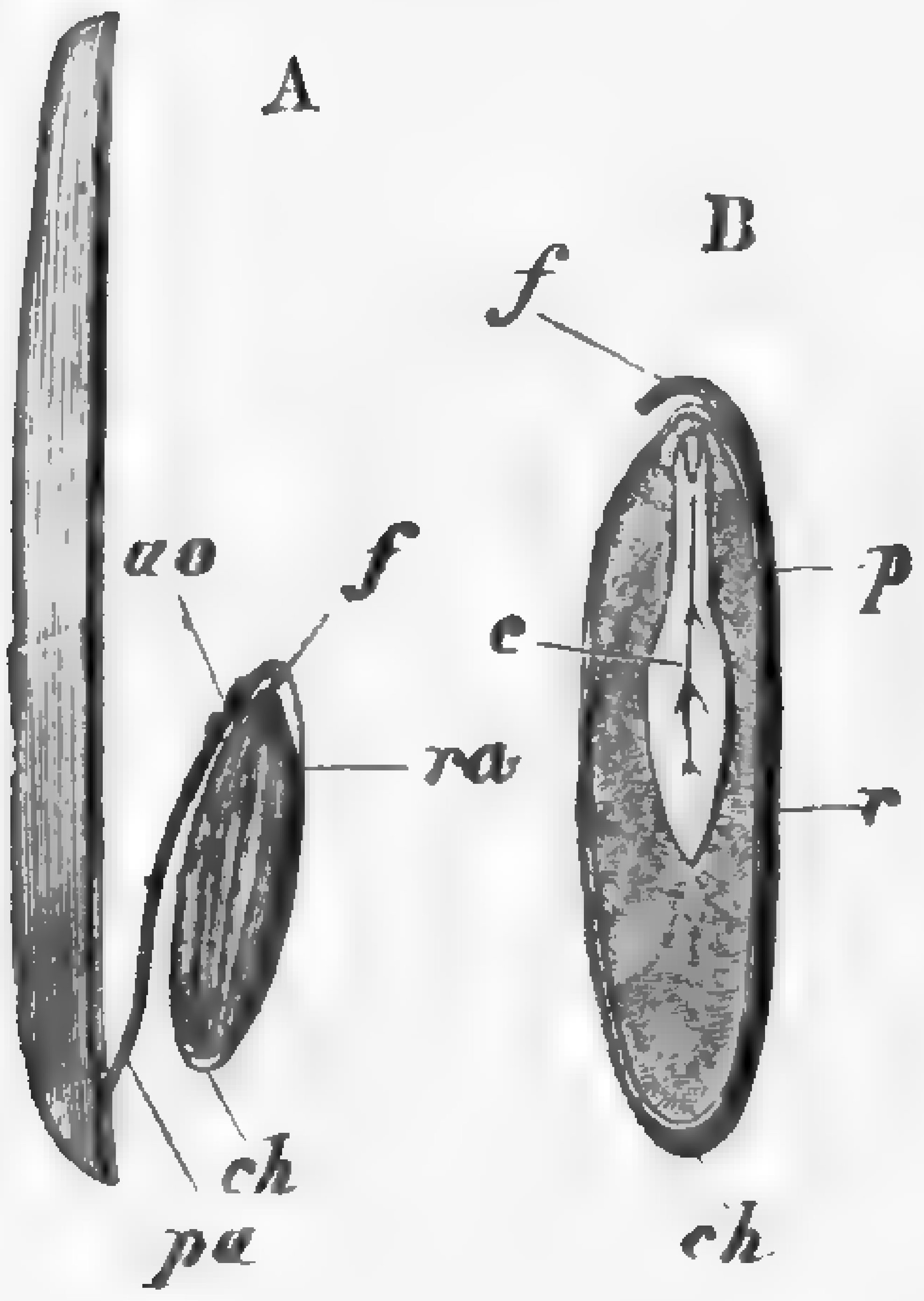


Fig. 45. A. Fruit of *Platanus*, longitudinal section, × 6. *w*, woody part. B. Transverse section, × 12.

Fig. 46. A. Samara of *Fraxinus excelsior*, nat. size, with one half removed and the seed pulled out. *pa*, placental axis; *ao*, abortive ovule; *f*, funicle. B. Longitudinal section of seed.

Except where otherwise stated, *c* stands for cotyledon; *oc*, outer cotyledon; *ic*, inner cotyledon; *ch*, chalaza; *e*, embryo; *f*, funiculus; *h*, hilum; *m*, micropyle; *p*, perisperm; *r*, radicle; *t*, testa.

Fig. 47.

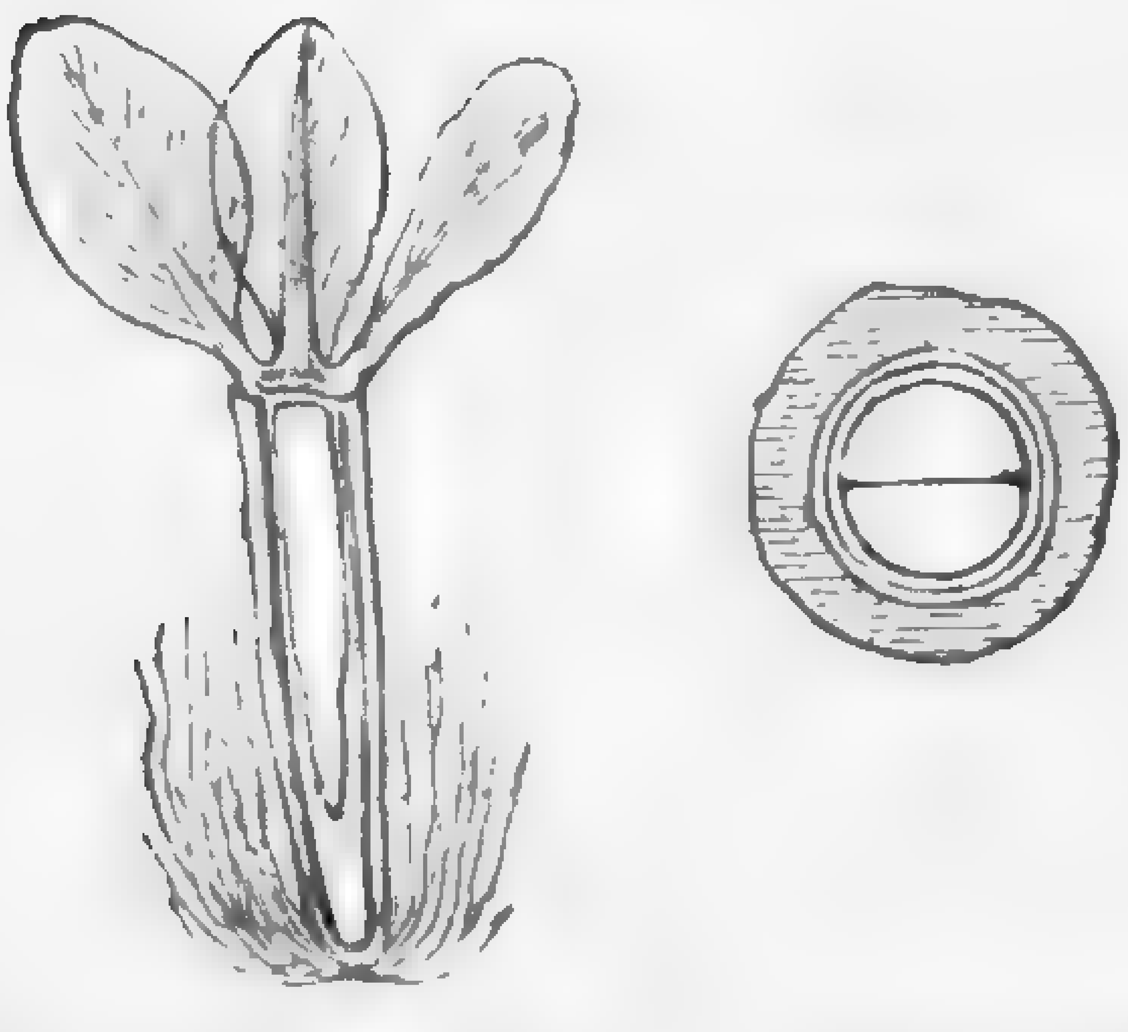


Fig. 48.

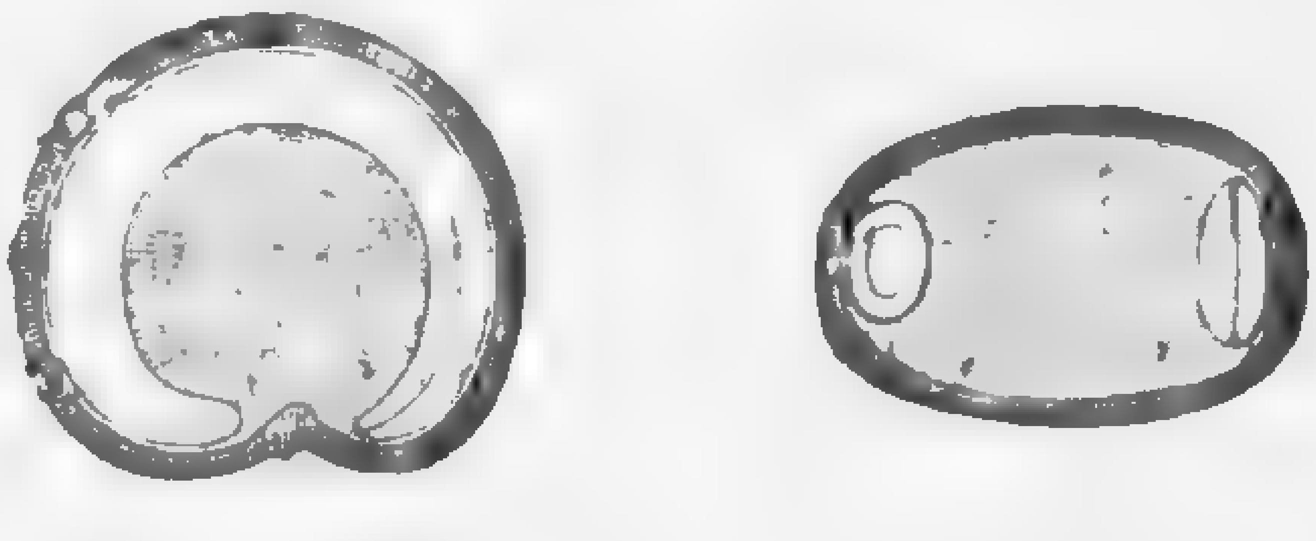


Fig. 47. Achene of *Ursinia speciosa*. Longitudinal section, × 2½. Transverse section, × 10.

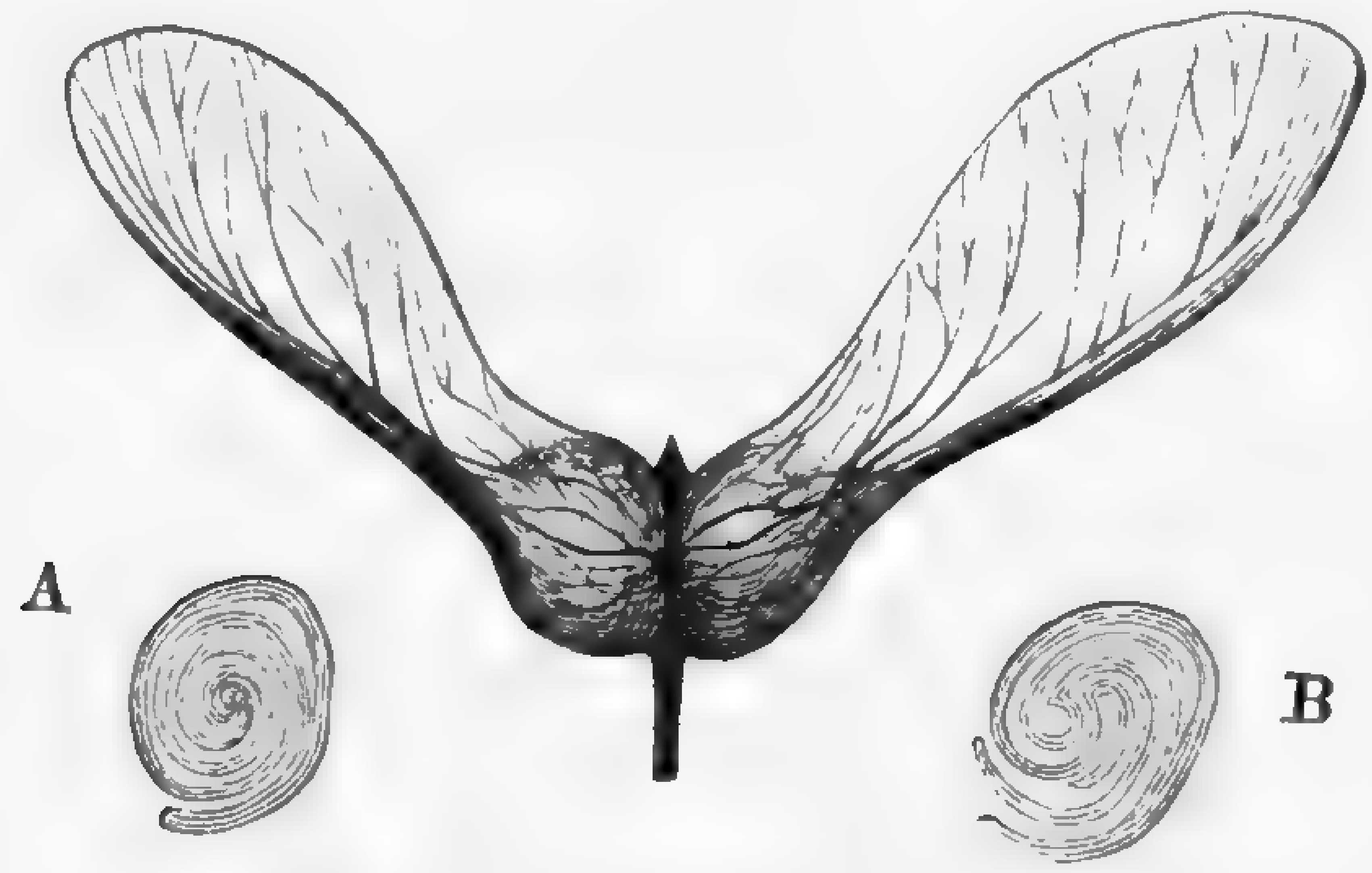
Fig. 48. *Chenopodium Bonus-Henricus*, vertical and transverse sections of seed.

(figs. 49 and 50) is laterally compressed and horseshoe-shaped, with a crest along the edge; the seed (fig. 51) conforms to the shape of the fruit, and the embryo is curved and linear, the cotyledons being applied to one another face to face, and at right angles to the plane of the seed, so that the edges of the cotyledons touch the walls of the seed at each side.

Fig. 49. Fig. 50. Fig. 51.

Menispermum canadense.
Fig. 49. Germinating seedling, × 2. Fig. 50. Vertical section of seed, × 4.
Fig. 51. Transverse section of seed, × 2.

Fig. 52.



Acer Pseudo-Platanus.
Fruit, nat. size. A, B. Embryo, showing two modes of arrangement of cotyledons.

The Sycamore (*Acer Pseudo-Platanus*, fig. 9) has also narrow cotyledons; but the arrangement is very different. The fruit (fig. 52) is winged, the seed somewhat obovoid and aperispermic—that is to say, the embryo, instead of lying embedded in food-material, occupies the whole cavity of the seed. Now if we wished to pack a leaf into a cavity of this form, it would be found convenient to choose one of a long strap-like shape, and then roll it up into a sort of ball. This is, I believe, the reason why this form of cotyledon is most suitable in the case of the Sycamore. The mode of folding, however, as shown in fig. 52, A and B, is not

always the same. I shall suggest a reason for the difference further on.

Broad Cotyledons.

I now pass to species with broad cotyledons. The Acorn, Nut, Bean (*Phaseolus*, fig. 53), and Pea aff rd familiar cases, in which

Fig. 53.

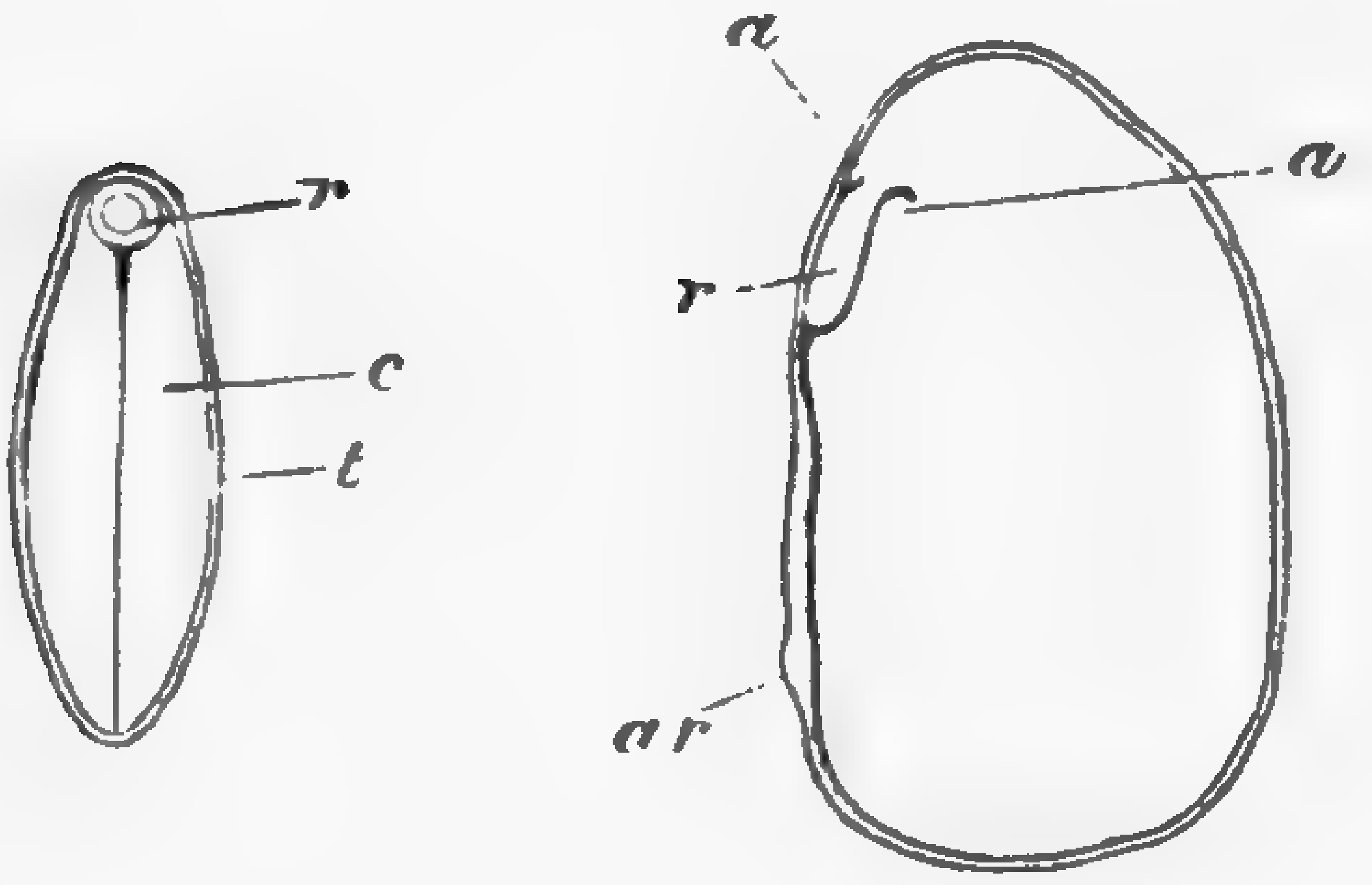


Fig. 54.

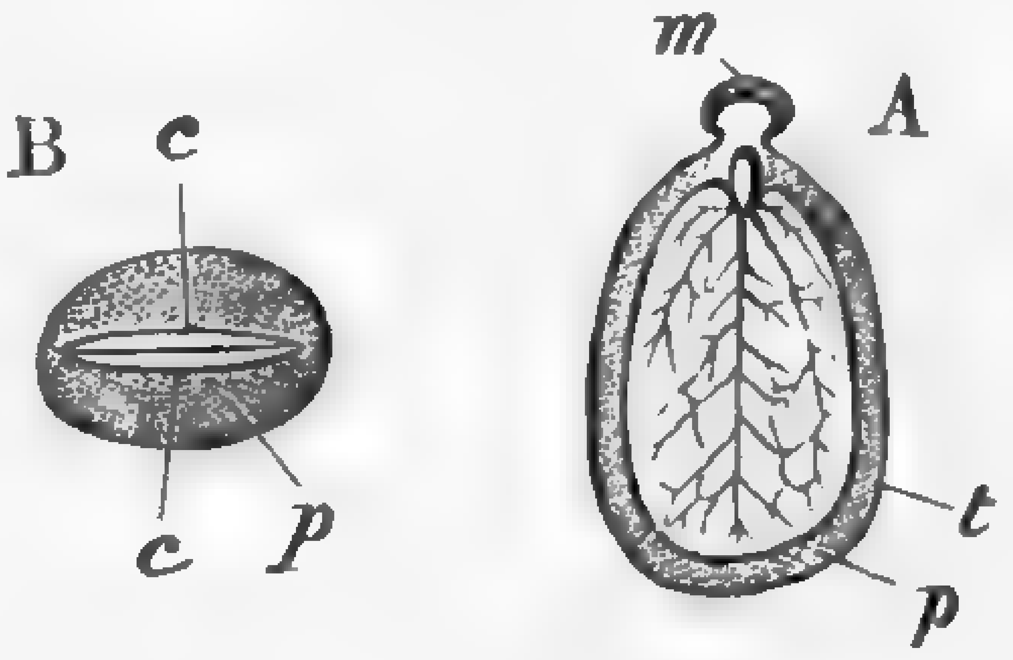


Fig. 55.

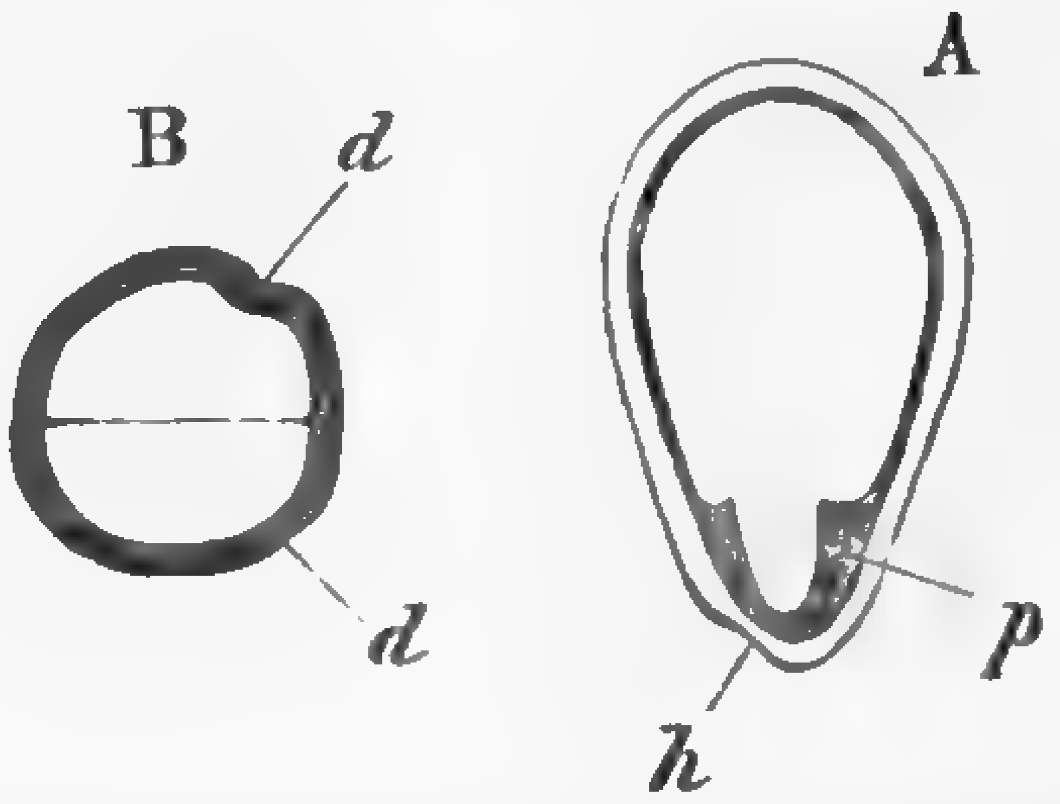


Fig. 53. *Phaseolus multiflorus.* Section of seed parallel and vertical to cotyledons, three fourths nat. size. *a*, *a*, auricles; *ar*, arillode.

Fig. 54. *Ricinus sanguineus.* A. Longitudinal section of seed, nat. size. B. Transverse section of seed, nat. size.

Fig. 55. *Hippophaë rhamnoides.* A. Longitudinal section of seed, × 4. B. Transverse section of seed. *d d*, depressed line.

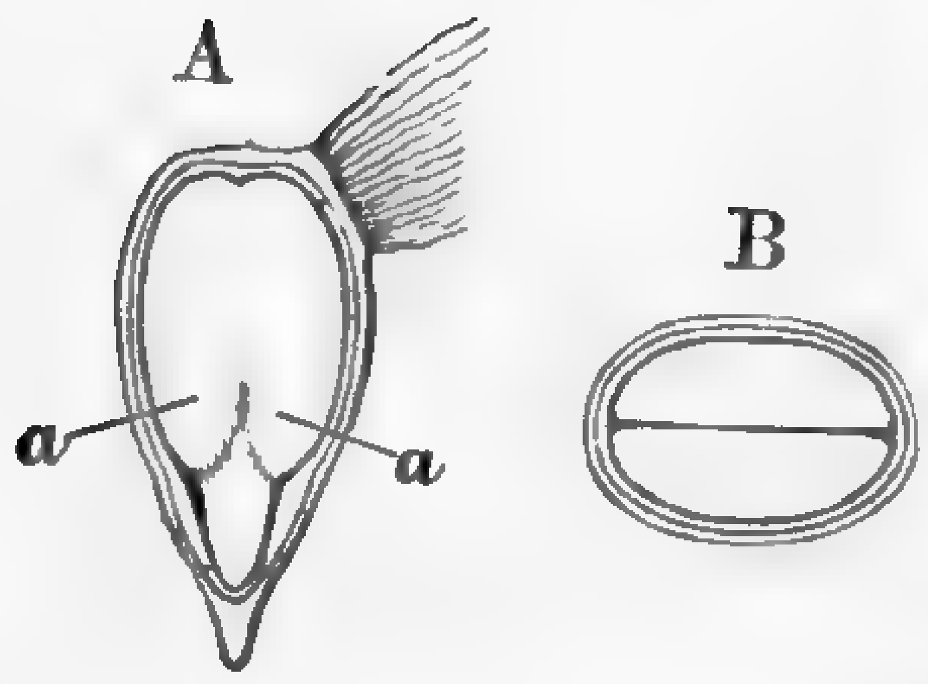
the two broad, fleshy, thickened cotyledons conform to and occupy the whole seed. In the Castor-oil plant (*Ricinus*, fig. 11) the seed (fig. 54) is ovoid, oblong, somewhat compressed dorso-ventrally, and beautifully mottled, while the projecting knob at the hilum gives it very much the appearance of a beetle or large tick. The perisperm is abundant, fleshy, white, and surrounds the embryo. The embryo is straight, flat, large, central, and white; the cotyledons broad, obtuse oblong, and approximately following the general outline of the seed. In *Hippophaë* (fig. 14) we have a somewhat similar case; but the cotyledons are fleshy and occupy almost the whole of the seed (fig. 55). In *Euonymus*, again, the seed is obovoid, slightly compressed laterally. The perisperm is abundant, fleshy, firm, and white, entirely surrounding the embryo. The embryo is straight, flat, central, pale green, extending very nearly from one end of the seed to the other. The arrangement is very similar in the Apple. In the Flax the

seed is ovate, obliquely pointed, glabrous, plano-convex, laterally much compressed, placed edgeways on the placenta, and the cotyledons lie parallel to the flattened axis of the seed. In other cases the seeds are still more flattened, as in *Ailanthus, Passiflora, Cobæa, Stephanotis*, &c.

The Compositæ generally have narrow cotyledons. In *Moscharia*, however, they are somewhat broader, the seed (fig. 56) being obovoid, with the cotyledons lying the broad way.

Fig. 57.

Fig. 56.



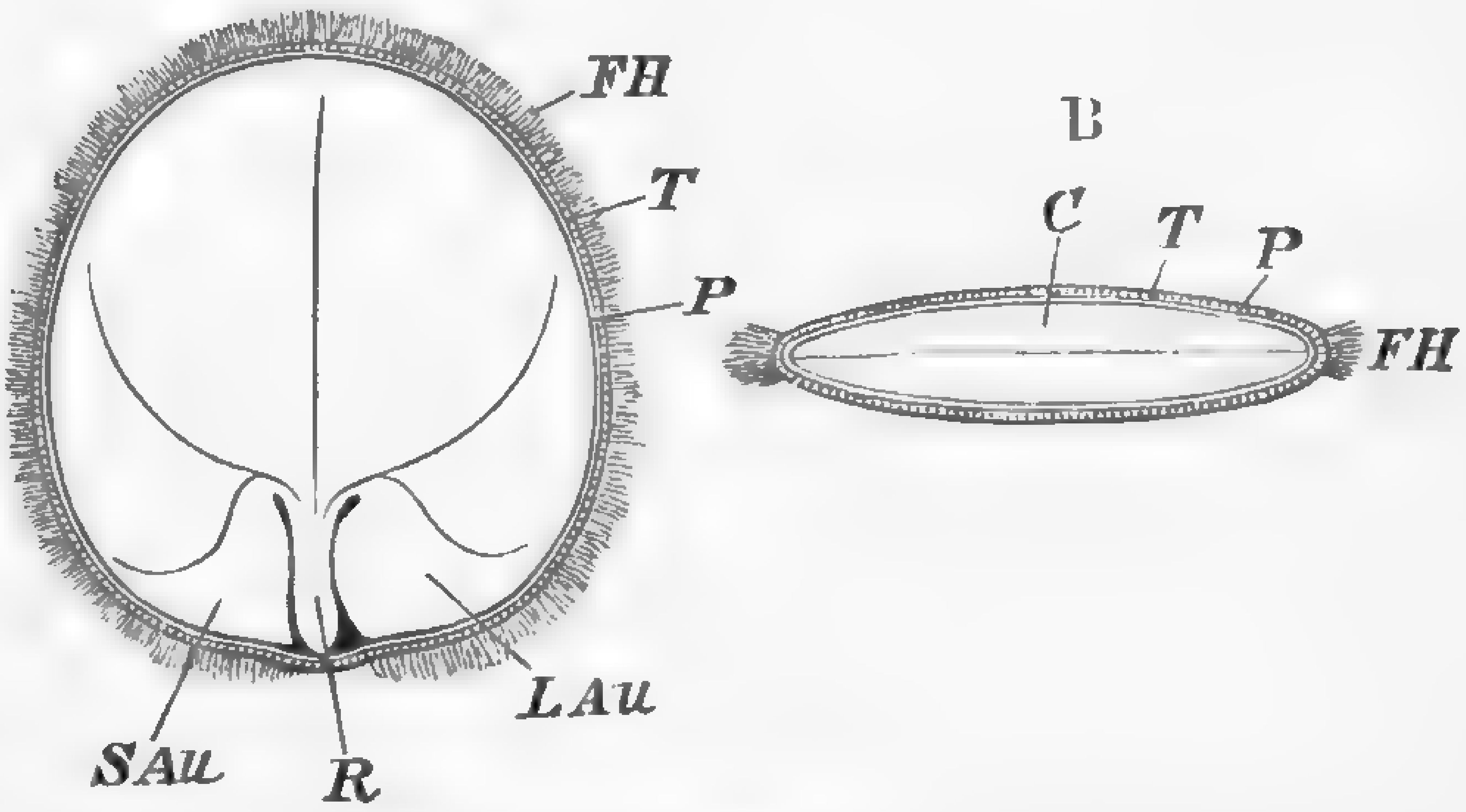


Fig. 56. *Moscharia pinnatifida*. A. Longitudinal section of seed, × 8. B. Transverse section of seed, × 8. *a a*, auricles.

Fig. 57. *Ruellia longifolia*. A. Longitudinal section of seed, × 10. B. Transverse section of seed, × 10. FH, fringe of hairs; LA*u*, larger, and SA*u*, smaller auricle.

In many cases, seeds of the same shape produce cotyledons of very different form.

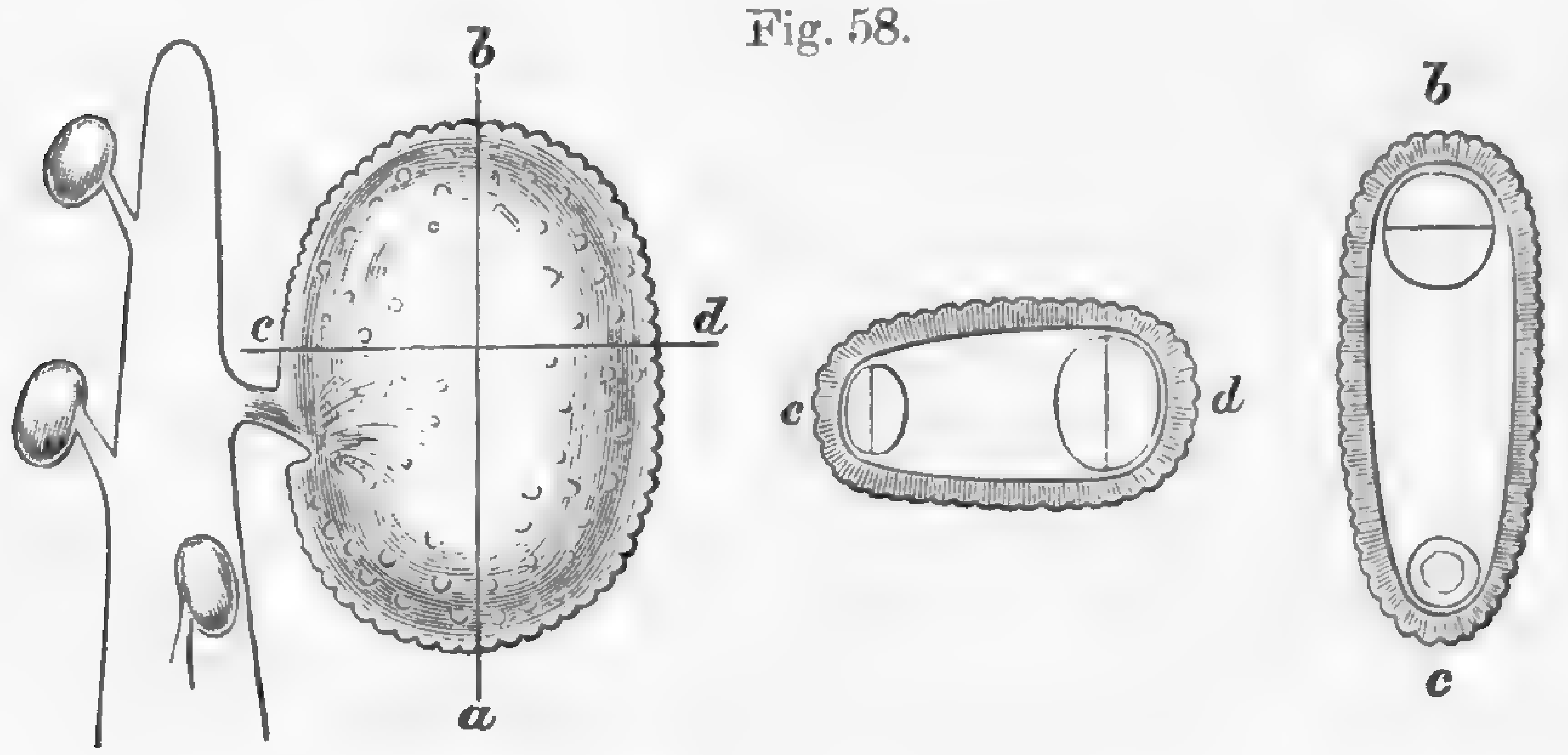
Compare together, for instance, *Ruellia* (fig. 16 seedling, and fig. 57 seed) and *Cerastium* (fig. 23 seedling, and fig. 58 seed). Both have compressed, nearly orbicular seeds, but in *Ruellia* the cotyledons are broad, in the Chickweed they are narrow. If, however, we make sections of the seeds, the cause of this difference becomes obvious, because in one (fig. 57) the cotyledons lie parallel, in the other (fig. 58) transverse, to the seed.

The form of the cotyledons often differs greatly even in the same family.

The Caryophyllaceæ, the family to which the Pink belongs, afford an interesting illustration. The cotyledons are placed with their backs to the placenta, and in most species are narrow, as in *Cerastium* (fig. 23). In some of them, however, such as the Pink itself (*Dianthus*, fig. 22) and *Tunica*, they are wide.

Now in most genera, as in the Chickweed, *Stellaria*, *Spergularia*, *Cerastium*, &c., the seeds are laterally compressed; the cotyledons consequently lie transversely to the seed, and their width therefore is limited by the thickness of the seed, as in fig. 58. The case is, however, somewhat complicated by the fact that the seed and embryo are both curved.

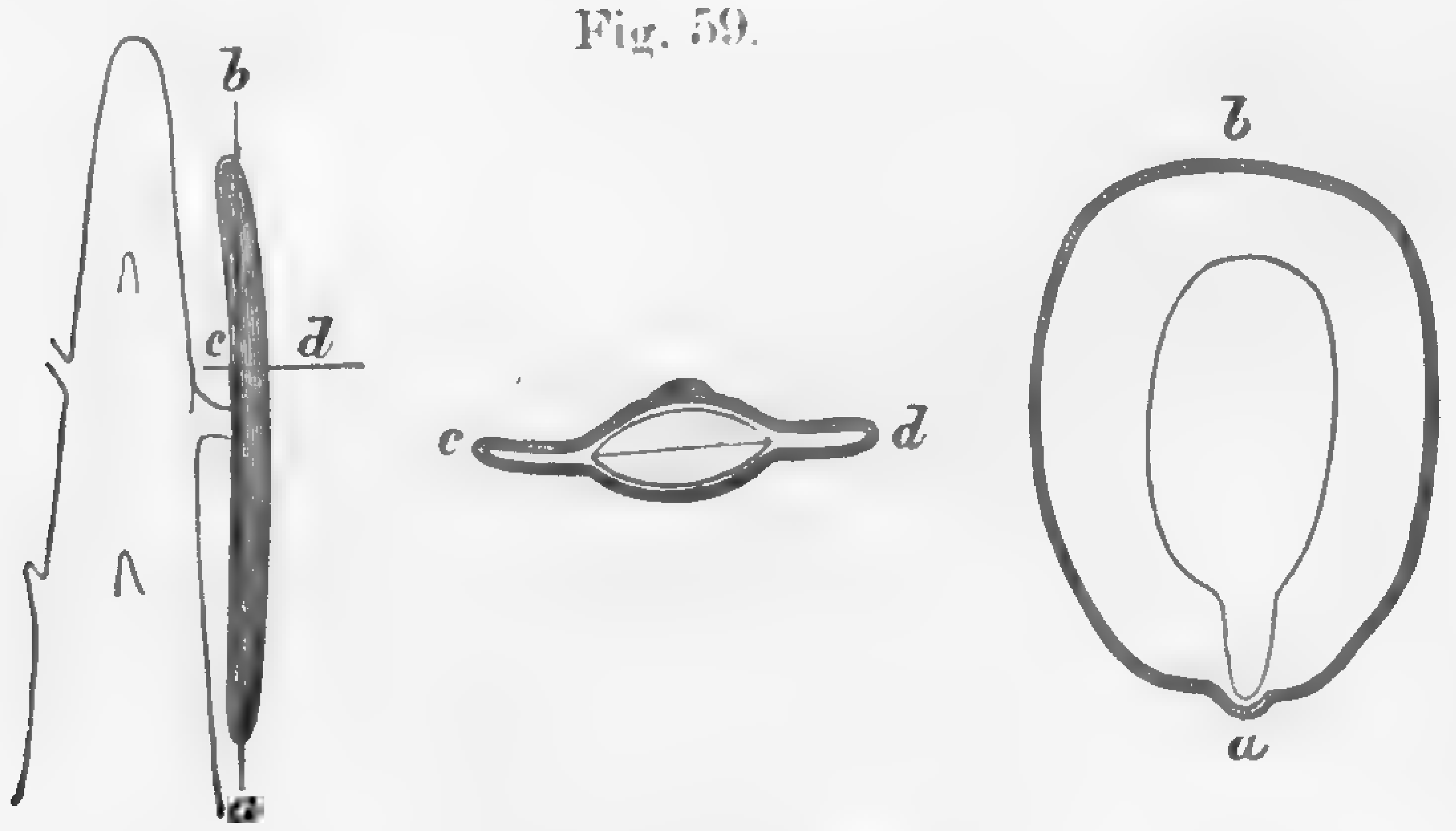
Fig. 58.



Cerastium arvense, × 15.

On the other hand, in the Pink (fig. 59) the seeds are not laterally but dorsally compressed, attached to the columnar placenta by the middle of the interior face, so that the cotyledons are straight, parallel to the seeds, and have in consequence plenty of room to widen out.

Fig. 59.



Dianthus Caryophyllus, × 15.

In figs. 58 & 59 the letters *a*, *b*, and *c*, *d* indicate the directions of the sections.

In *Solanum* the fruit is globose, scarlet when ripe, glabrous, indehiscent, and many-seeded. The seeds are kidney-shaped, much compressed laterally, and placed with their narrow

edge to the placenta, surrounded by a paler margin, glabrous and white; the hilum is small, and on the middle of the ventral edge. The embryo is, in the mature seed, much curved, embedded in, but lying near the outer edge of, the perisperm. The radicle occupies the lower and narrow part of the seed. The cotyledons are linear, not broader than the radicle, curved, with their tips close to the hilum, and their back to the placental axis, and at right angles to the plane of the seed, the whole width of which accordingly they occupy, so that they cannot grow any wider. On the other hand, while the fruit of *Cestrum* is not very unlike that of *Solanum*, the seeds are very different in shape, being peltate, more or less obovate, with the broad end towards the apex of the seed, so that the cotyledons have room to widen themselves.

Sometimes we meet with species having both narrow and broad cotyledons, even in the same genus. For instance, *Coreopsis filifolia* (fig. 6) has narrow, *Coreopsis auriculata* broad, cotyledons.

Fig. 60.

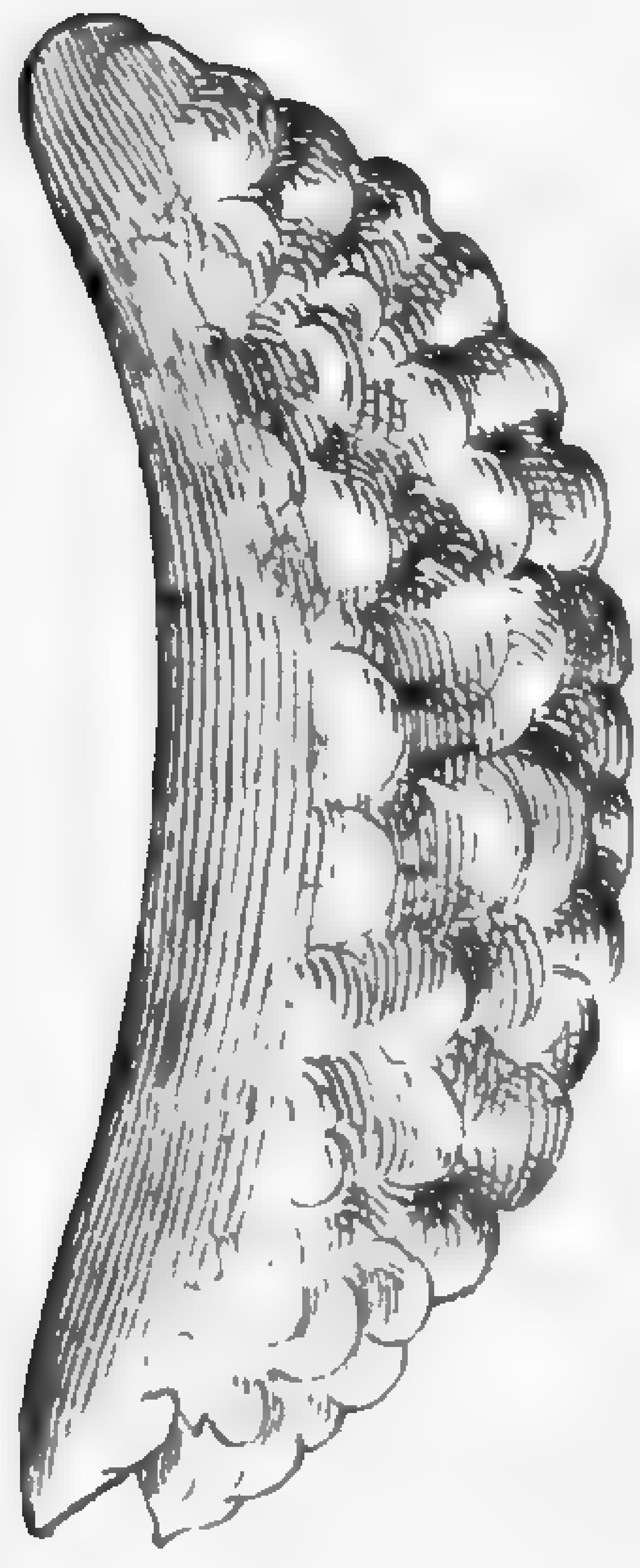


Fig. 61.

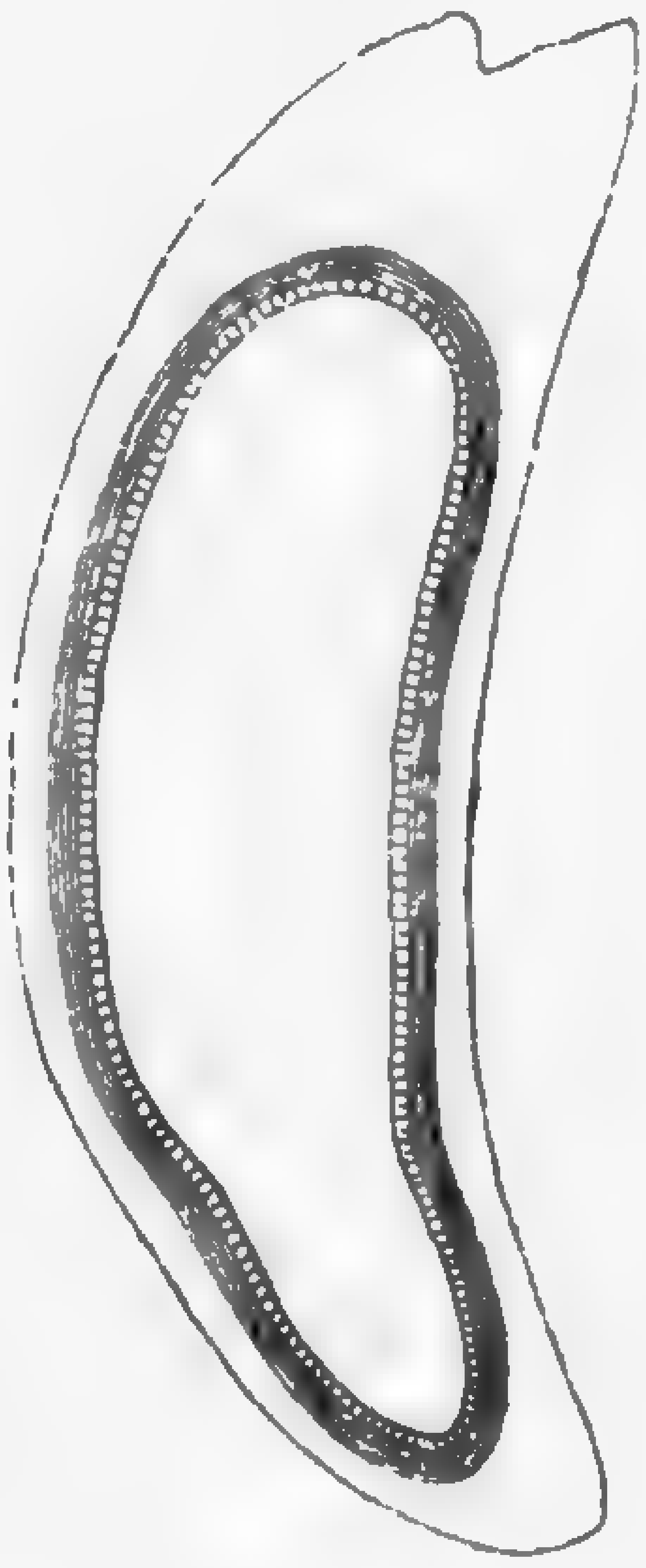


Fig. 62.

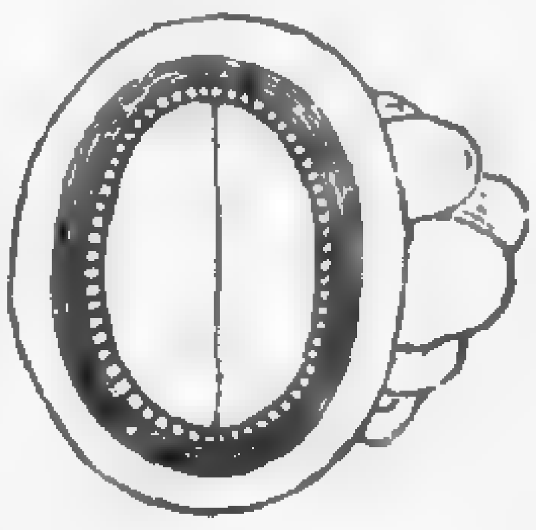


Fig. 63.

Coreopsis filifolia.

Fig. 60. Achene, × 14. Fig. 61. Longitudinal section, × 14.
Fig. 62. Transverse section, × 14. Fig. 63. Embryo, × 14.

If, however, we examine the seeds we find that those of *C. filifolia* are narrow or subcylindrical (fig. 61), while those of *C. auriculata* (fig. 64) are broad obovate; and as in both cases the

embryo fills the seed, this difference sufficiently accounts for the dissimilarity in the cotyledons.

Fig. 64.

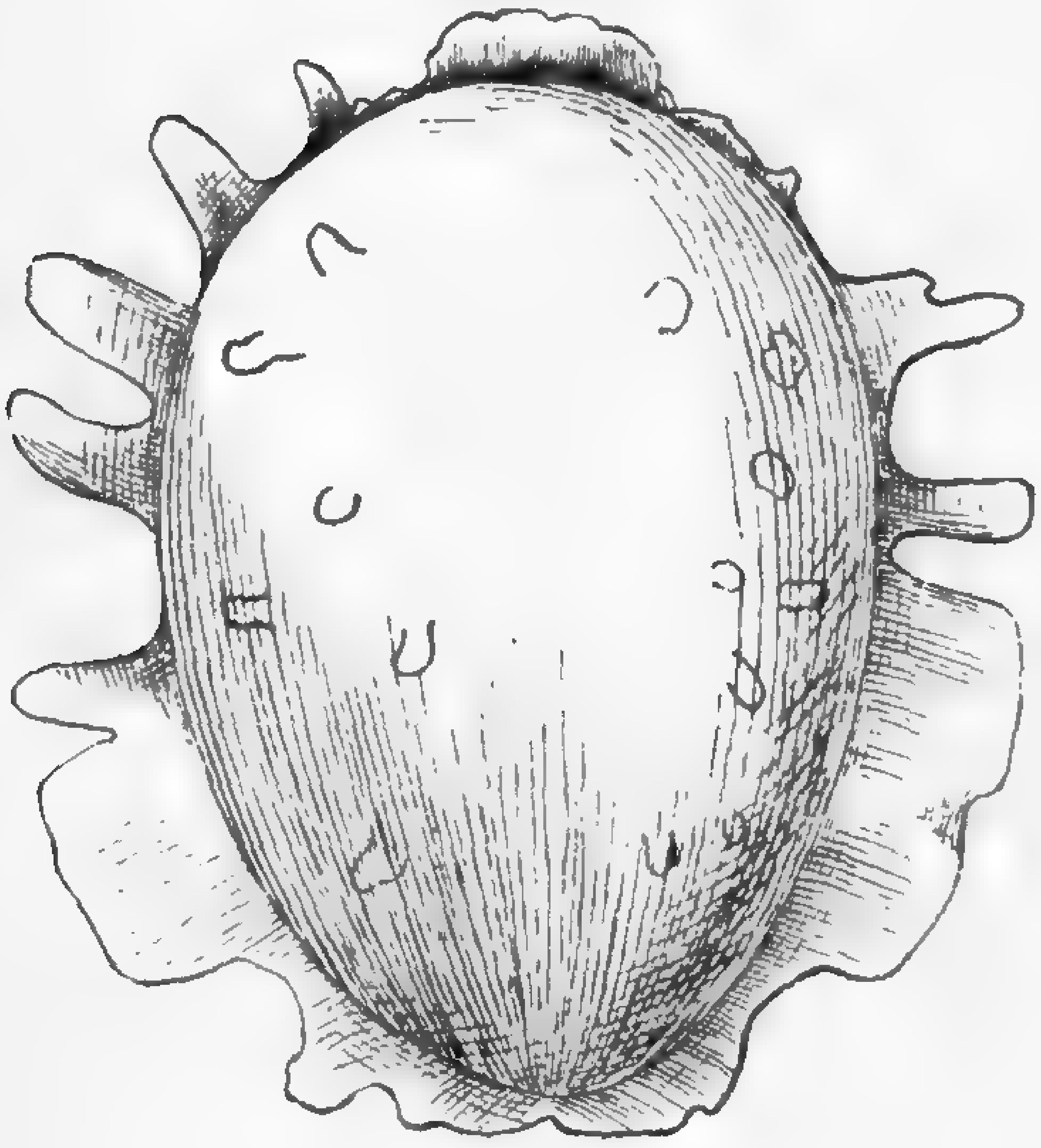


Fig. 65.

Fig. 66.

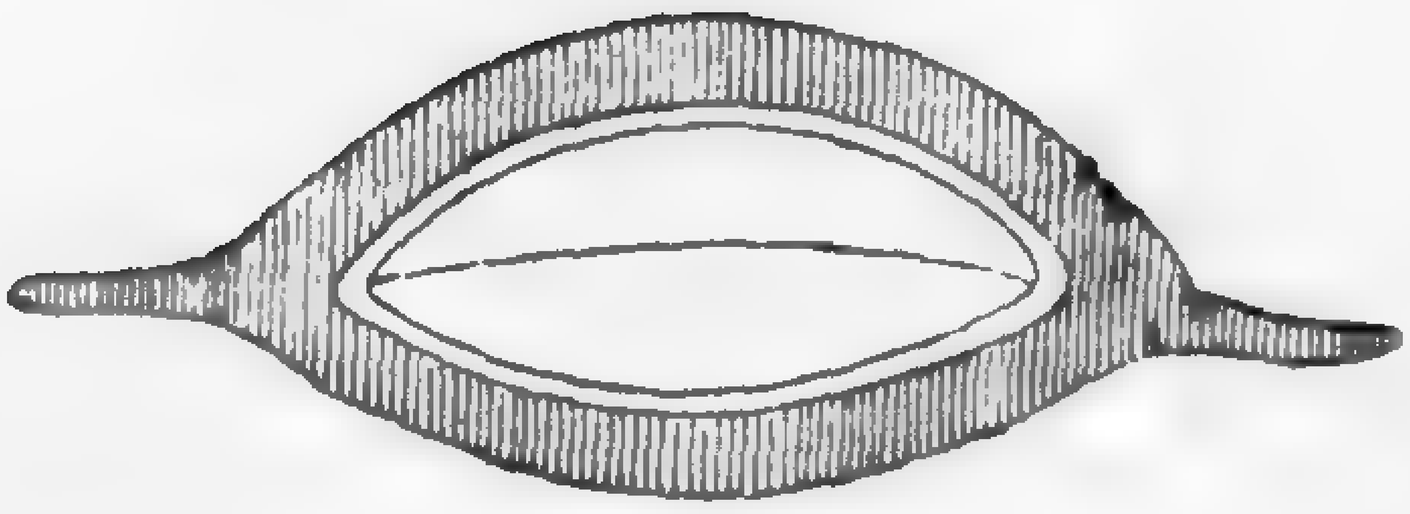


Fig. 67.

Coreopsis auriculata.

Fig. 64. Achene, × 14. Fig. 65. Longitudinal section, × 14.
Fig. 66. Transverse section, ×14. Fig. 67. Embryo, ×14.

The genus *Galium* is an interesting case. Here also we find some species with narrow, some with broad, cotyledons; but the contrast seems to be due to a very different cause. *G. Aparine* (fig. 114) has broad, *G. saccharatum* (fig. 24) narrow, cotyledons. In *G. saccharatum* the fruit (figs. 68–70) is deeply lobed, two-celled, two-seeded, indehiscent, and densely covered with tubercles. The seed is globose, deeply hollowed on the ventral

surface. The embryo (fig. 68, *r c*) is curved, following the concavity of the hollow, with the larger part of the perisperm lying towards the periphery. The cotyledons are linear and obtuse. Fig. 69 shows that, so far as the form of the seed is concerned, there is no reason why the cotyledons should not be much broader than they are. The explanation may perhaps be found in the structure of the pericarp (fig. 68, *p.c*), which is thick, tough, and corky.

Fig. 68.

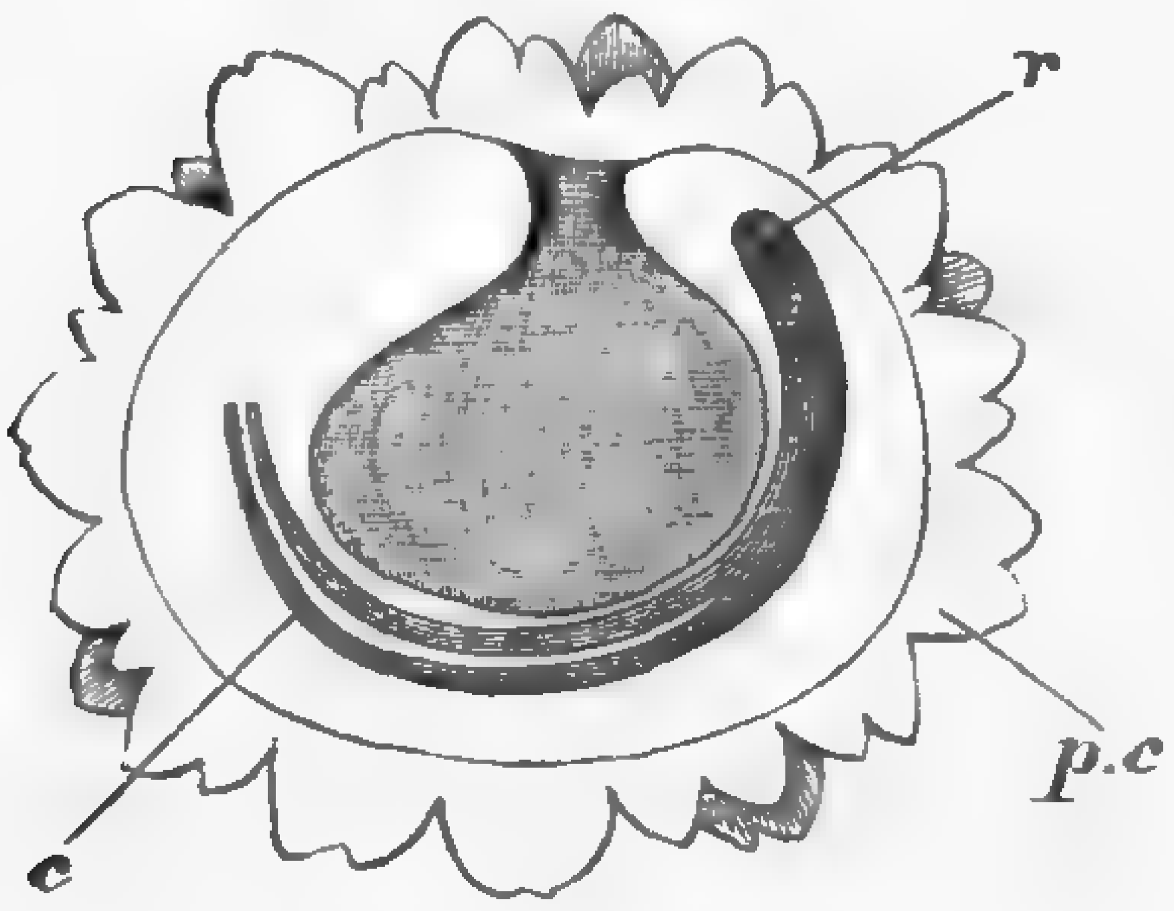


Fig. 69.

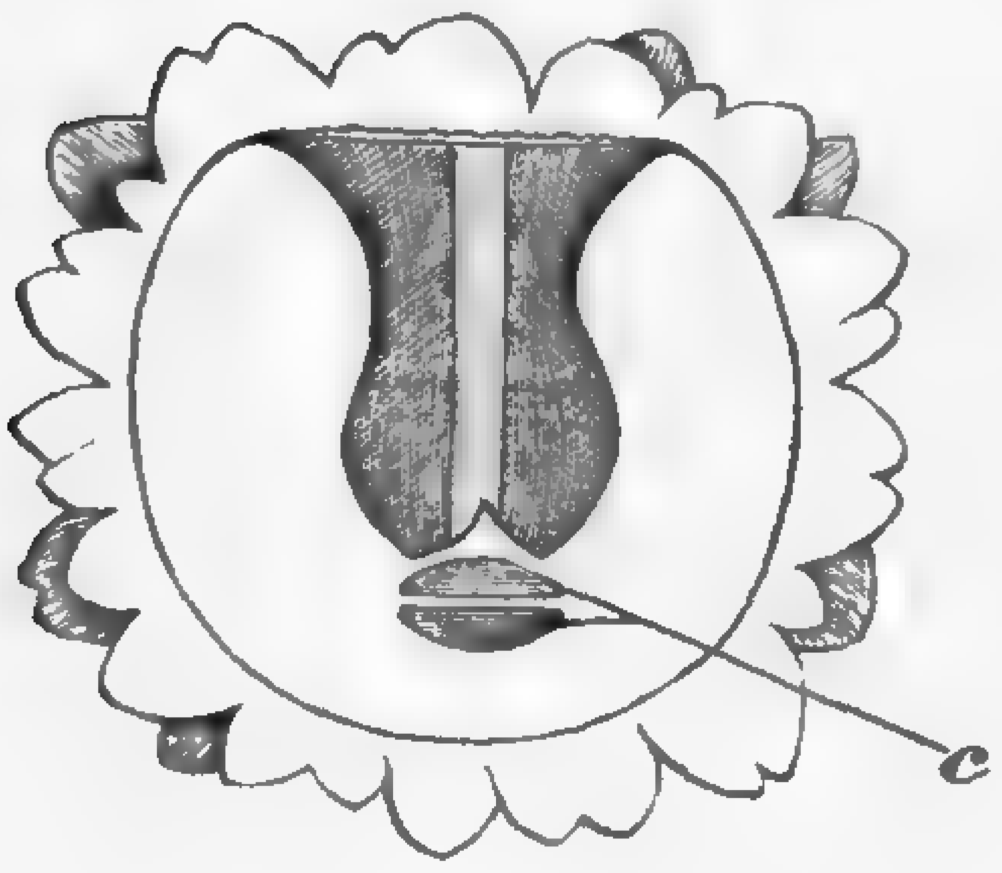
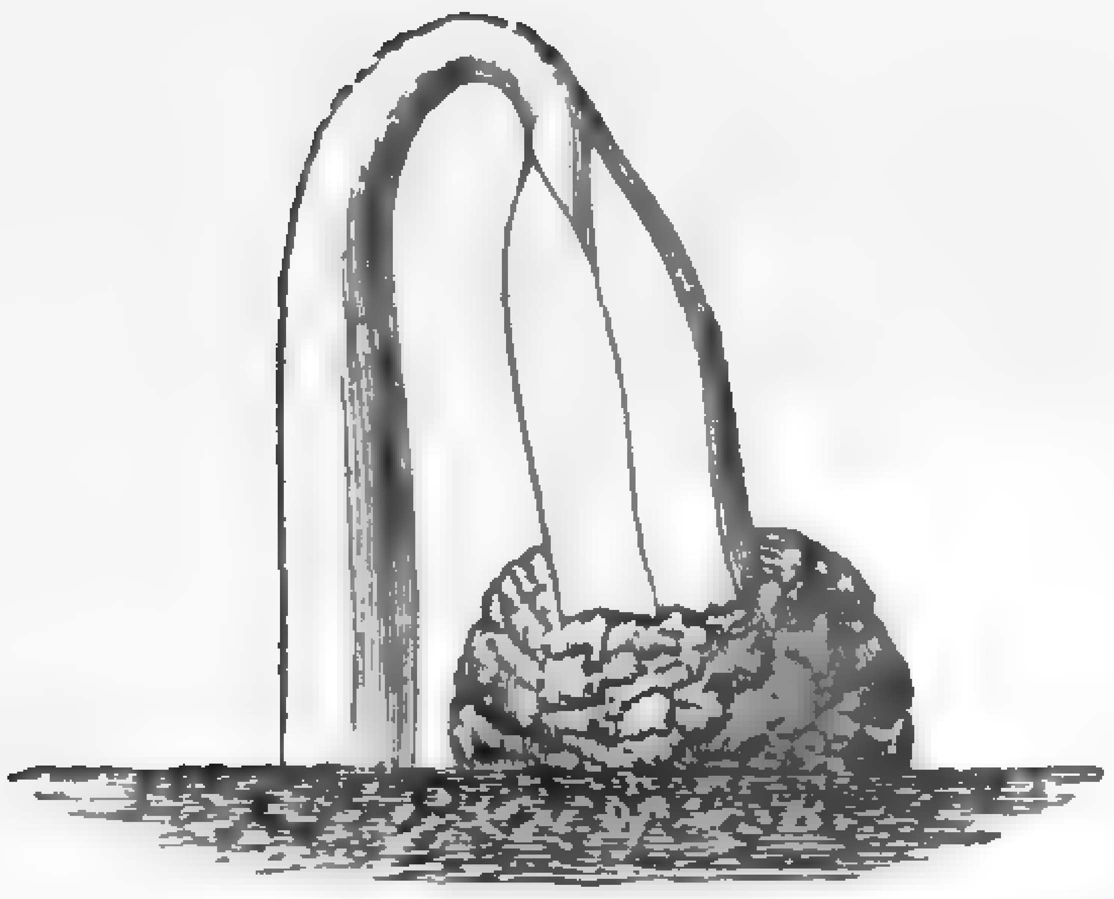


Fig. 70.



Galium saccharatum.

Fig. 71.

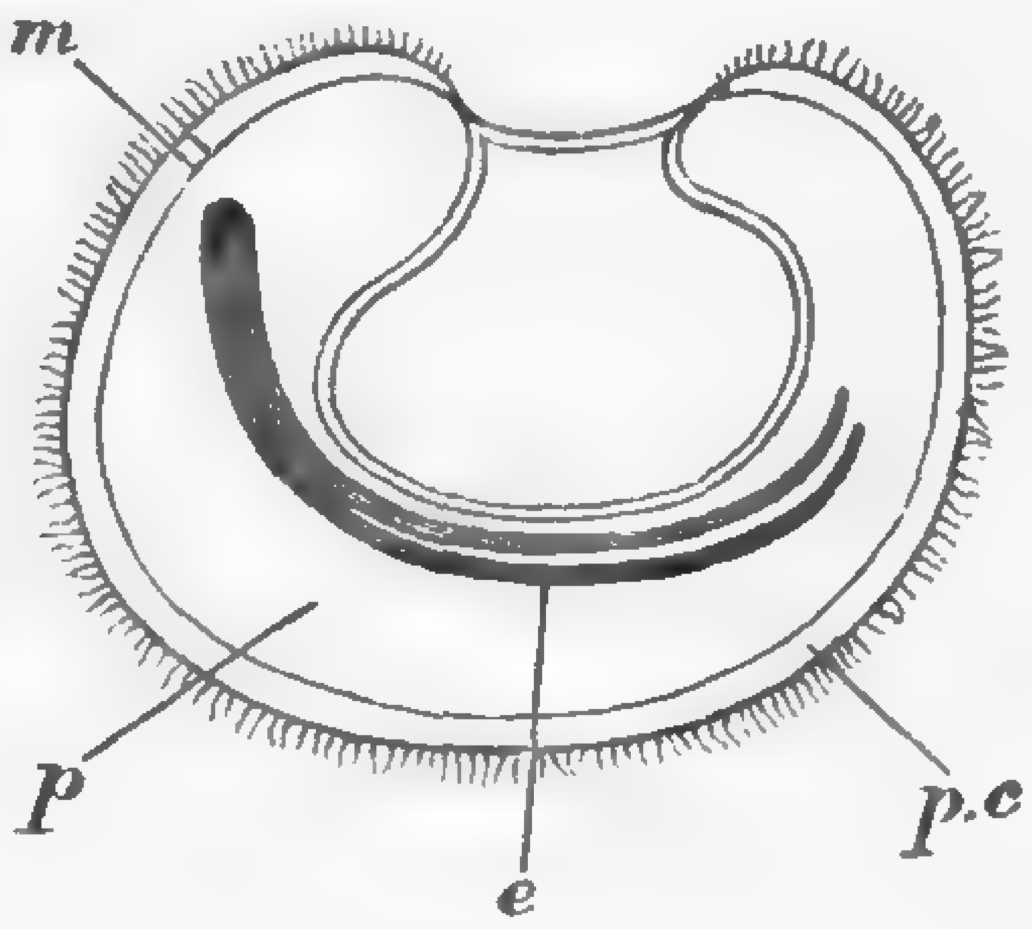


Fig. 72.

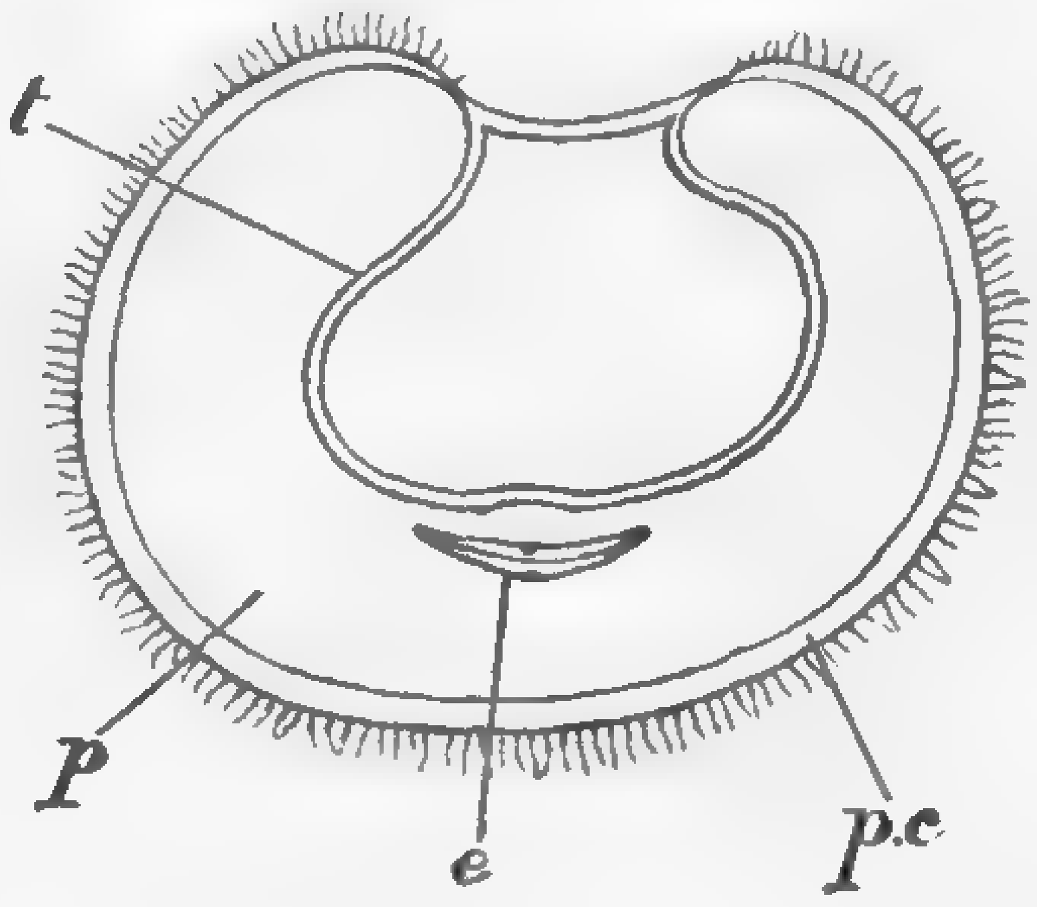
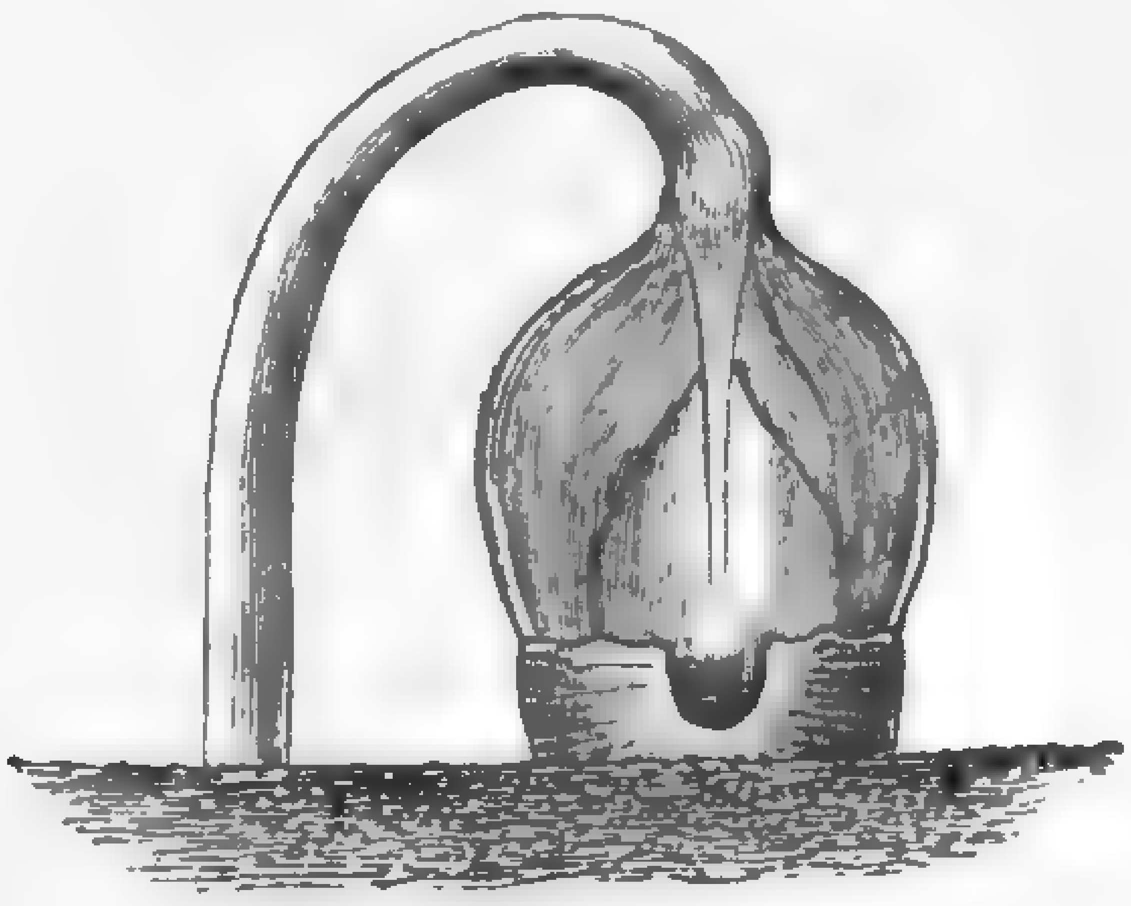


Fig. 73.



Galium Aparine.

Fig. 68. Longitudinal section of seed, × 8. Fig. 69. Transverse section of seed, × 8. Fig. 70. Germinating seedling, × 4.

Fig. 71. Longitudinal section of seed, × 8. Fig. 72. Transverse section of seed, × 8. Fig. 73. Germinating seedling, × 4.

It is very impervious to water, and may be advantageous to the embryo by resisting the attacks of drought and of insects, and perhaps if the seed be swallowed by a bird, by protecting it from being digested. On the other hand it does not split open, and is too tough to be torn by the embryo. The cotyledons, therefore, if they had widened, as they might otherwise have done, would have found it impossible to emerge from the seed. They evade the difficulty, however, by remaining narrow. On the other hand, in *G. Aparine* the pericarp is much thinner (figs. 71–73), and the embryo is able to tear it open (fig. 73). In this case, therefore, the cotyledons can safely widen without endangering their exit from the seed.

The thick corky covering of *G. saccharatum* is doubtless much more impervious to water than the comparatively thin testa of *G. Aparine.* The latter species is a native of our own isles, while *G. saccharatum* inhabits Algiers, the hotter parts of France, &c. May not, then, perhaps the thick corky envelope be adapted to enable it to withstand the heat and drought?

In all these species the cotyledons are flat or nearly so, but a large number are enabled to widen themselves by being more or less folded. One form of this is afforded by the Radish (*Raphanus*) and *Brassica* (fig. 3). Fig. 74 shows a seed of *Raphanus sativus,* and, as shown in figs. 75–78, the latter of which represents a young seedling, the cotyledons are applied to one another face to face, and then folded along the middle.

Unequal Cotyledons.

I now turn to those species in which the two cotyledons are unequal in size.

Several of these cases have been discussed by Darwin*, who attributed the inequality to the fact of "a store of nutriment being laid up in some other part, as in the hypocotyl, or one of the two cotyledons, or one of the secondary radicles." I differ with the greatest hesitation from so high an authority; but do not see the connection between the store of food being partly laid up in some other part of the plant and the inequality between the cotyledons. Why should it affect one more than the other? I venture to suggest that the difference is rather due to the position of the embryo in the seed, which in some cases favours one cotyledon more than the other. For instance, in

* 'Movements of Plants,' p. 94.

many cases the cotyledons are what is called "incumbent," that is to say the radicle is folded upon one of the cotyledons, and in such species the outer cotyledon is often rather larger than the other, as for instance in *Hesperis matronalis*.

Fig. 74.

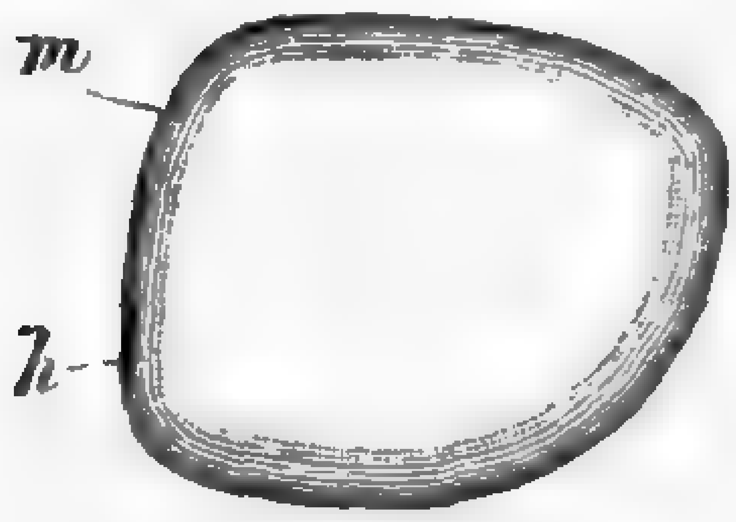


Fig. 75.

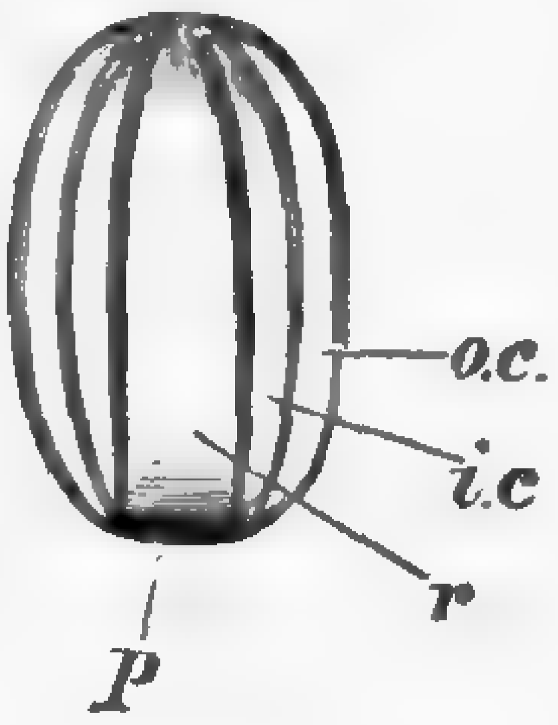


Fig. 78.

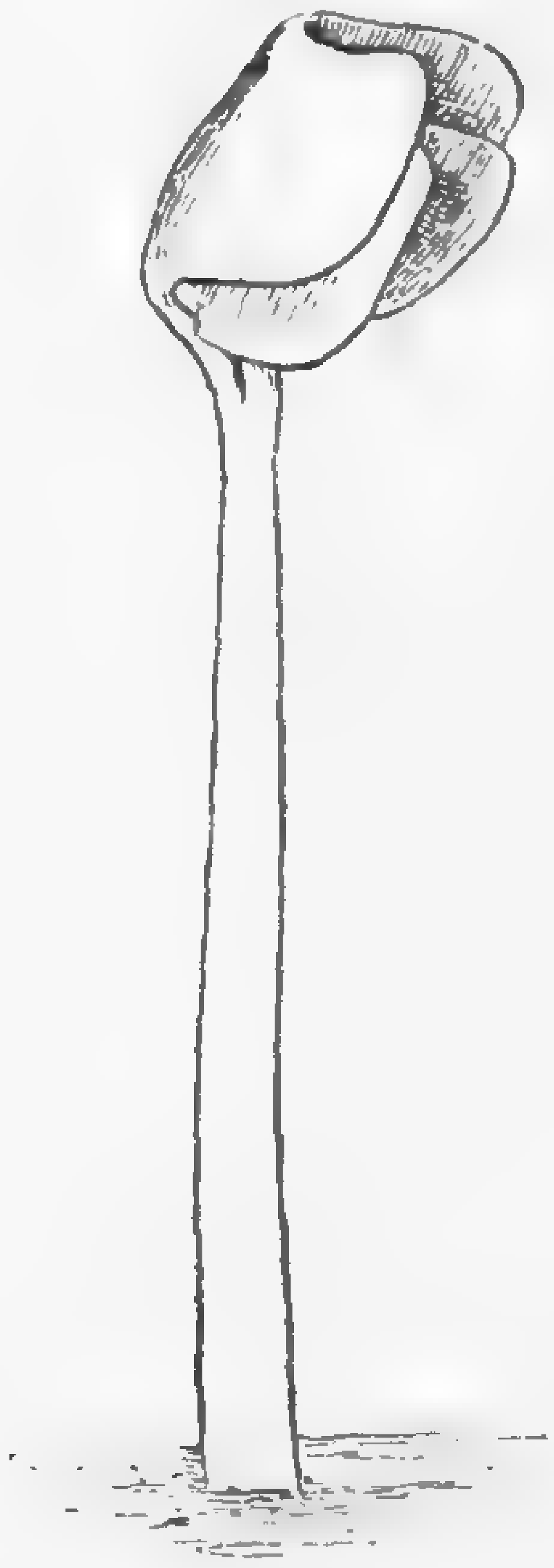


Fig. 76.

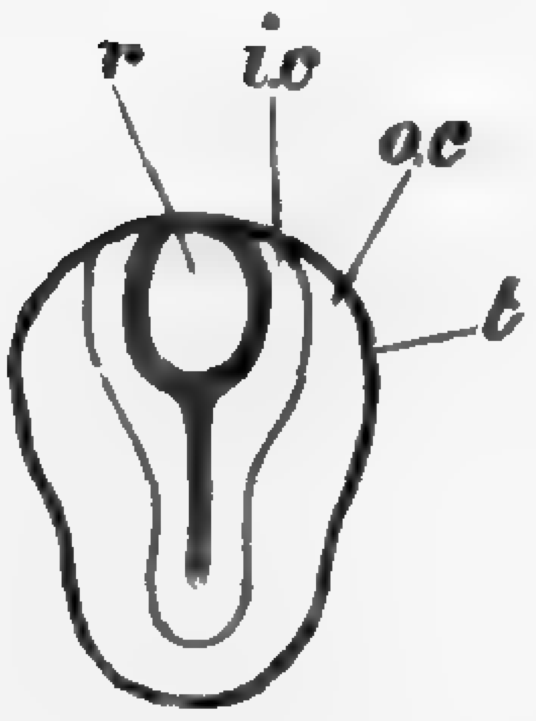
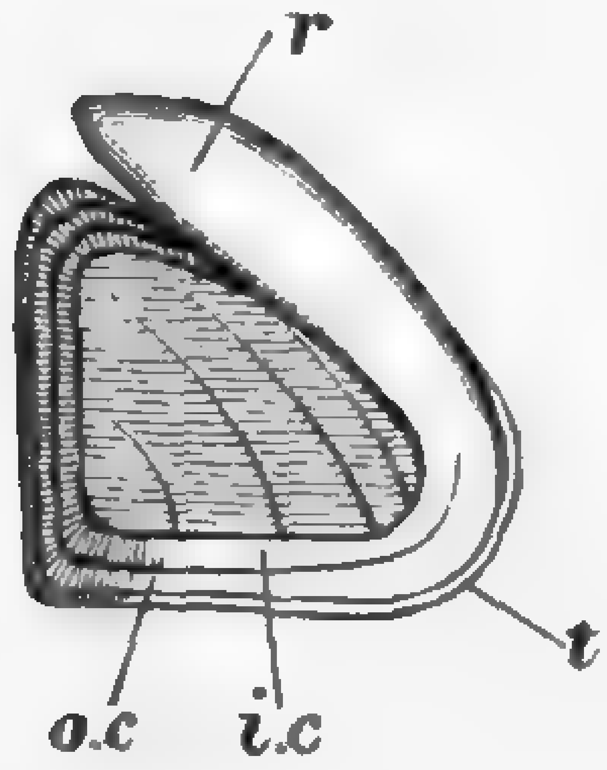


Fig. 77.



Raphanus sativus.

Fig. 74. Outline of seed, × 4: *m*, micropyle; *h*, hilum. Fig. 75. Embryo extracted from seed, × 4. Fig. 76. Embryo, × 4; vertical section. Fig. 77. Embryo, seen from the side, × 4: *o.c*, outer cotyledon; *i.c*, inner cotyledon; *r*, radicle; *t*, testa. Fig. 78. Germinating seedling, × 2, showing the cotyledons still folded.

In the Mustard (fig. 3), Cabbage, Radish (*Raphanus*), and some other Crucifers the difference is more marked, and is due to a different cause. The cotyledons, as just mentioned, are applied to one another face to face (figs. 75–77), and then doubled longitudinally one inside the other. The outer one, therefore, having more space, becomes larger and the petiole is longer. In *Cereus* (fig. 79) the embryo is much curved, and the cotyledons being thick and fleshy, the inner one is naturally smaller than the outer.

In *Abronia umbellata* (fig. 80 B) the embryo is large, much curved or doubled on itself, and lies outside the perisperm, the two edges of the cotyledon reaching almost to the radicle. The second cotyledon (*ic*) is minute, generally not more than one seventh the length of the outer one, though in one seed it attained nearly half the length of the other. In another species of the

same genus, *A. arenaria*, the smaller cotyledon is reduced to a mere knob (fig. 80 A, *ic*).

Fig. 79.

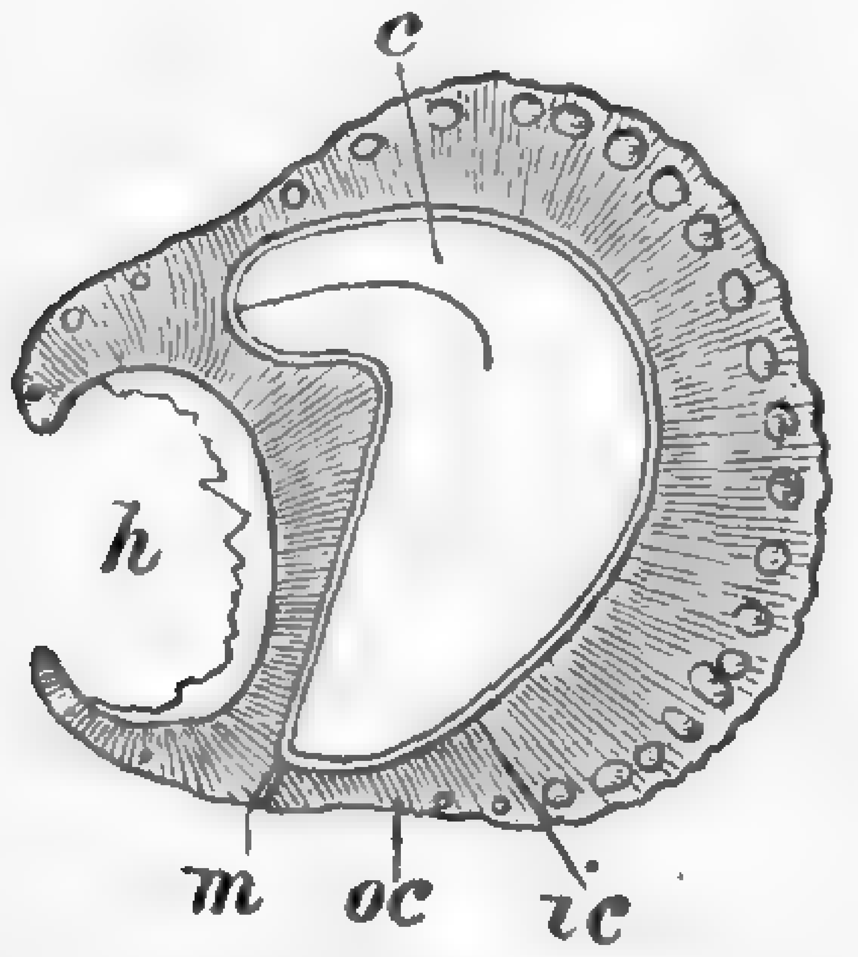


Fig. 80.

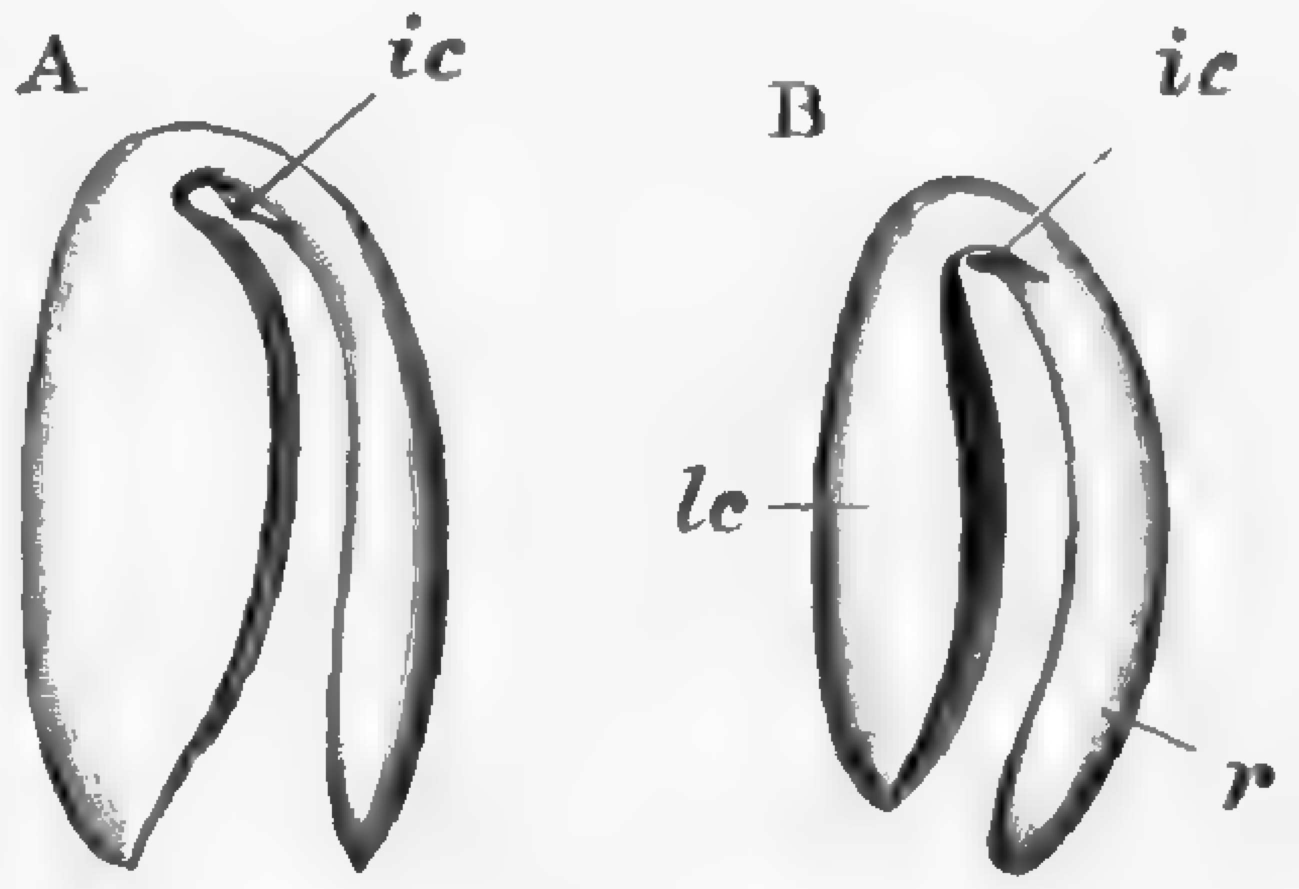


Fig. 79. *Cereus Napoleonis.* Section of seed. *oc*, outer coat of testa; *ic*, inner coat of testa.

Fig. 80. A. Embryo of *Abronia arenaria*, × 6: *ic*, smaller cotyledon. B. Embryo of *A. umbellata*, × 6: *ic*, right and inner cotyledon; *lc*, left cotyledon.

Cases in which one of the cotyledons is rudimentary also occur in the genera *Ranunculus* *, *Carum* †, *Cyclamen*, &c.

In *Petiveria octandra* (fig. 81) the cotyledons are very interesting. The one is about 3 centim. long, $1\frac{1}{4}$ broad, oblong, tapering

Fig. 81.

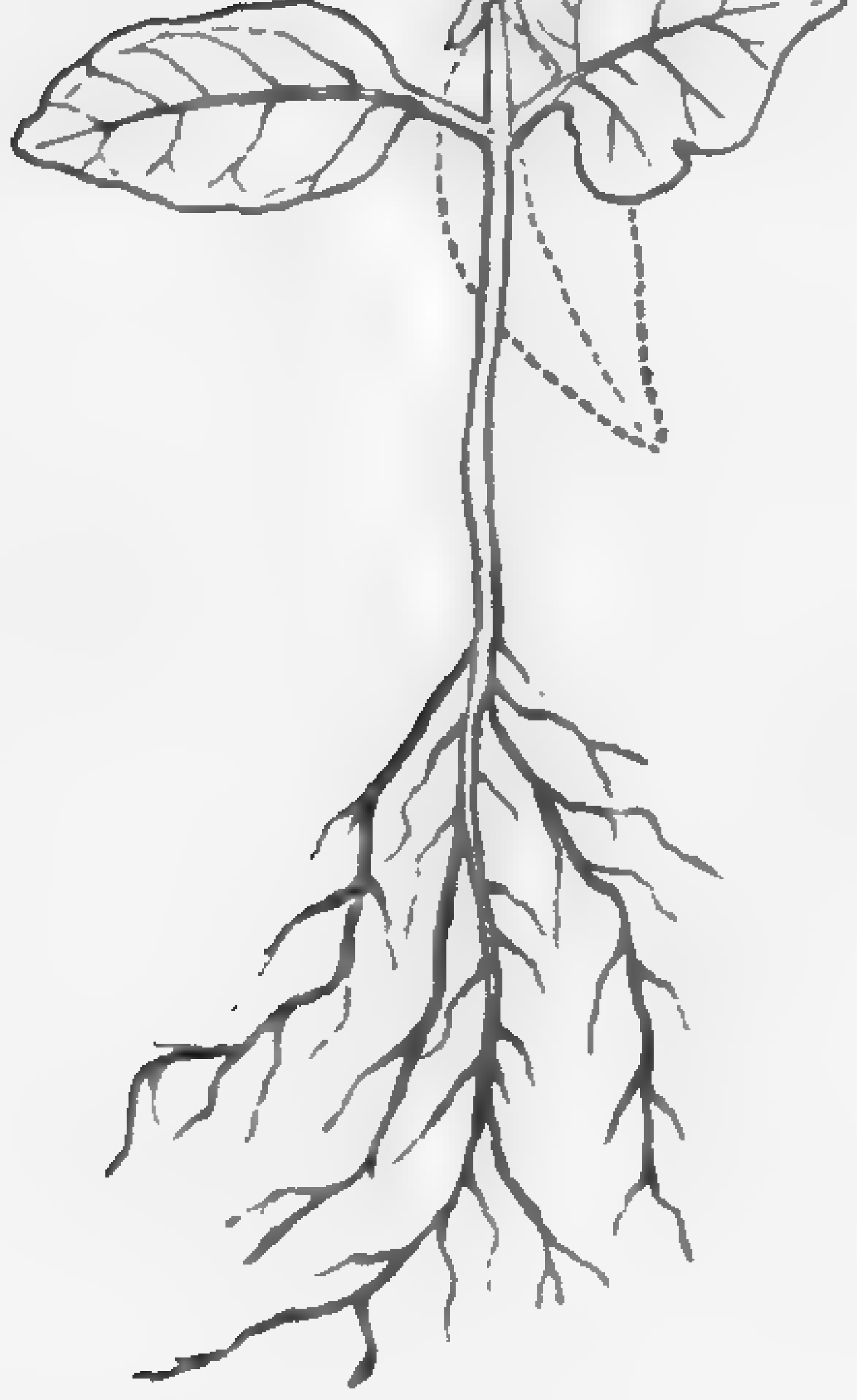


Fig. 82.

Fig. 83.

Fig. 84.

Petiveria octandra.

Fig. 81. Seedling, half nat. size. Fig. 82. Embryo partly unfolded, × 6. Fig. 83. Outer and shorter cotyledon. Fig. 84. Inner and longer cotyledon.

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* See Irmisch, 'Beit. zur vergl. Morphol. der Pflanzen' (Halle, 1854).

† Hegelmaier, Vergl. Untersuchungen, 1875.

at both ends, and entire. The other is shorter and broader, 2 centim. long by $1\frac{3}{4}$ broad, subcordate, with a large terminal lobe, and one, more or less pronounced, on each side. At first I thought this curious want of symmetry must be accidental. It is, however, normal, and is explained by the peculiar form of and arrangement of the embryo (figs. 82–84) in the seed. The fruit is an achene of peculiar form; it is oblong linear, subcuneate, and laterally compressed, bifid at the apex, and crowned with 2–6 unequal, closely reflexed, acute bristles, more or less hairy, one-celled, one-seeded, and indehiscent. The seed is oblong linear, and tapers somewhat, conforming to the interior of the fruit. The embryo is large; the longer cotyledon is doubled on itself; the broader one is also turned over at the end, and wraps round the narrower one*, not reaching, however, to the narrow end of the seed: the terminal lobe of the shorter and broader cotyledon is the part which is folded over, and the lateral lobes, which are much smaller in the embryo, are also due to the fold, as shown in figs. 82–84.

Unsymmetrical Cotyledons.

In other cases, as in the Geraniums (fig. 25), *Schinus* (fig. 28) (the false Pepper), *Clitoria* (fig. 27), Laburnum (fig. 26), Lupines, &c., there is inequality, not between the two cotyledons, but between the two halves of each cotyledon. In the Geraniums this is due to the manner in which the cotyledons are folded. In Cabbage and Mustard we have seen that one cotyledon is folded inside the other; in the Geranium they are convolute (fig. 85), one half of

Fig. 85.

Section through embryo of *Geranium*, showing the mode of folding of the cotyledons.

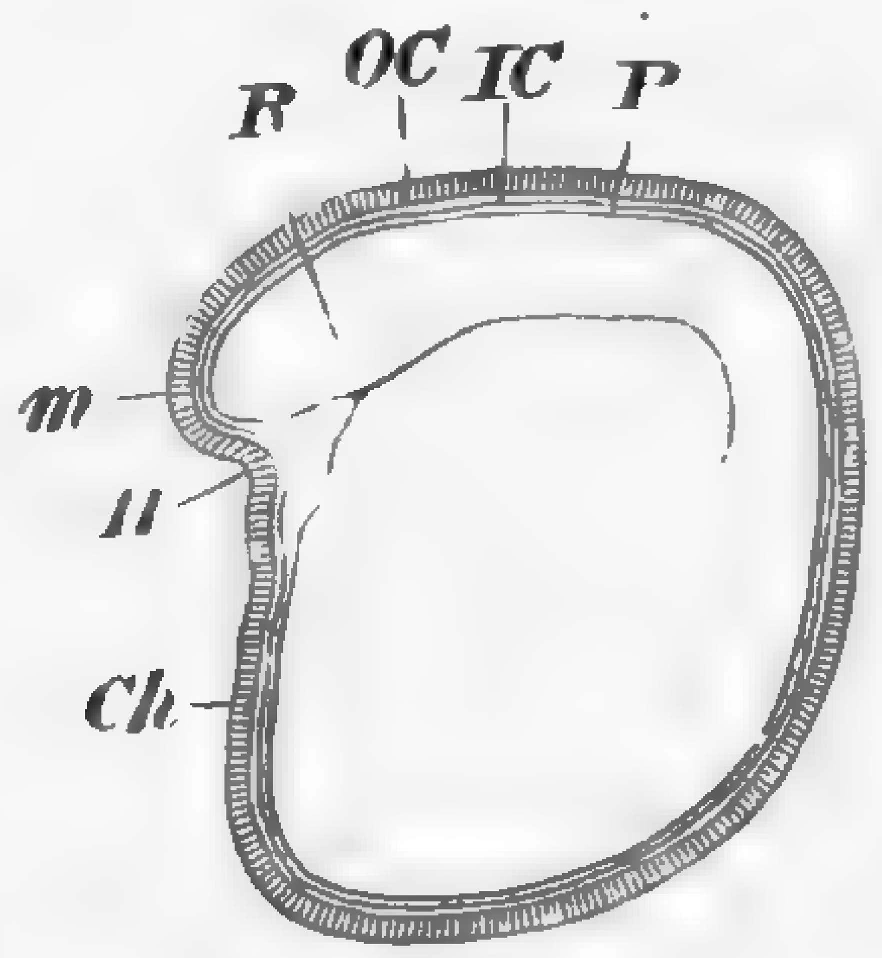
each being folded inside one half of the other—the two inner halves being the smaller, the two outer the larger ones.

In the Laburnum (fig. 26) and in *Clitoria* (fig. 27), where

* The narrow cotyledon is sometimes absent.

the arrangement is very similar, the inequality in the two sides of the cotyledon is due to the inequality between the two sides of the seed (fig. 86).

Fig. 86.



Seed of *Laburnum vulgare*, × 6. *OC*, outer coat; *IC*, inner coat.

In *Heritiera macrophylla* the cotyledons fill the seed, which conforms to the shape of the carpels, and the fact that these are somewhat unequal-sided renders the seed and consequently the cotyledons so likewise.

In the Lupines the seeds are obliquely oblong, compressed laterally, and without perisperm, the embryo being large, fleshy, yellowish, and occupying the whole seed. It is doubled on itself, and the cotyledons are folded along the radicle, which nearly equals them in length, with the smaller halves turned towards the radicle, and in such a manner that they and the radicle together occupy one half of the seed, and about equal the larger halves of the cotyledons, which fill the other.

In *Triphasia* the inequality is due, partly at any rate, to a different cause. The seeds are oval, somewhat flattened, especially on the ventral aspect. The embryo is large, and occupies the whole seed. The cotyledons are very unequal in size, and the smaller one is more or less enclosed in the larger. But, in addition to this, there are often, indeed generally, two and sometimes three embryos in each seed; these differ in size, and the smaller ones often intrude more or less on one of the cotyledons belonging to the larger ones.

Crenate Cotyledons.

The vast majority of plants have the edges of the cotyledons entire. There are some few, however, in which they are more or less crenate, as for instance in *Cordia subcordata* (fig. 33).

In this species the embryo occupies the whole of the ovoid-conical seed. There is no perisperm, and the cotyledons, in order

to occupy the whole space, are longitudinally folded (fig. 87), thus giving rise to the crenations on the margin.

Fig. 87.

Embryo of *Cordia subcordata*, × 2.

Accumbent and Incumbent Cotyledons.

There are two ways in which the radicle may be bent over the cotyledon.

Sometimes it is turned up over the back of one of the cotyledons, as in figs. 88 and 89, and is said to be incumbent; while sometimes it is turned along the edge of the cotyledons, as in figs. 90 and 91, which are then termed accumbent. The divisions

Fig. 88.

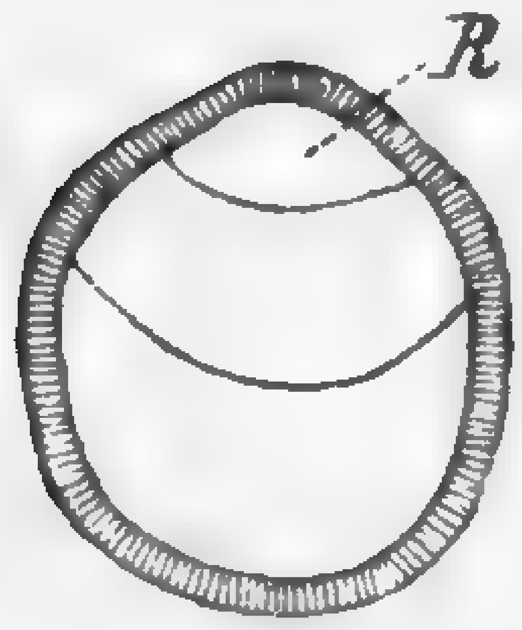
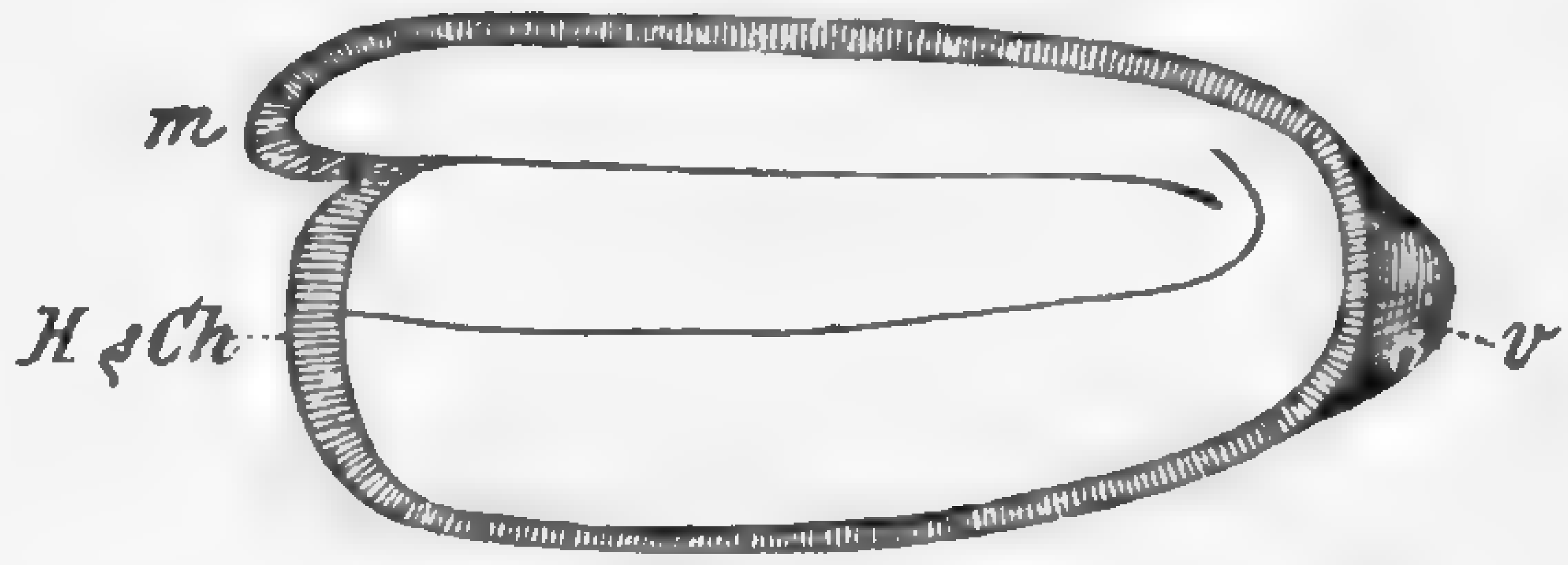


Fig. 89.



Figs. 88 and 89. Sections of seed of *Hesperis matronalis*, × 10. *v*, hollow in testa.

Fig. 90.

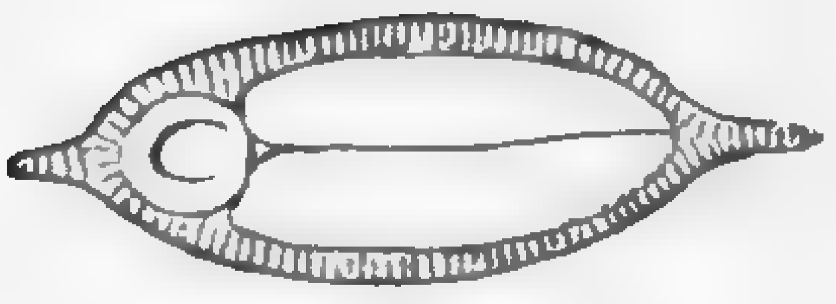
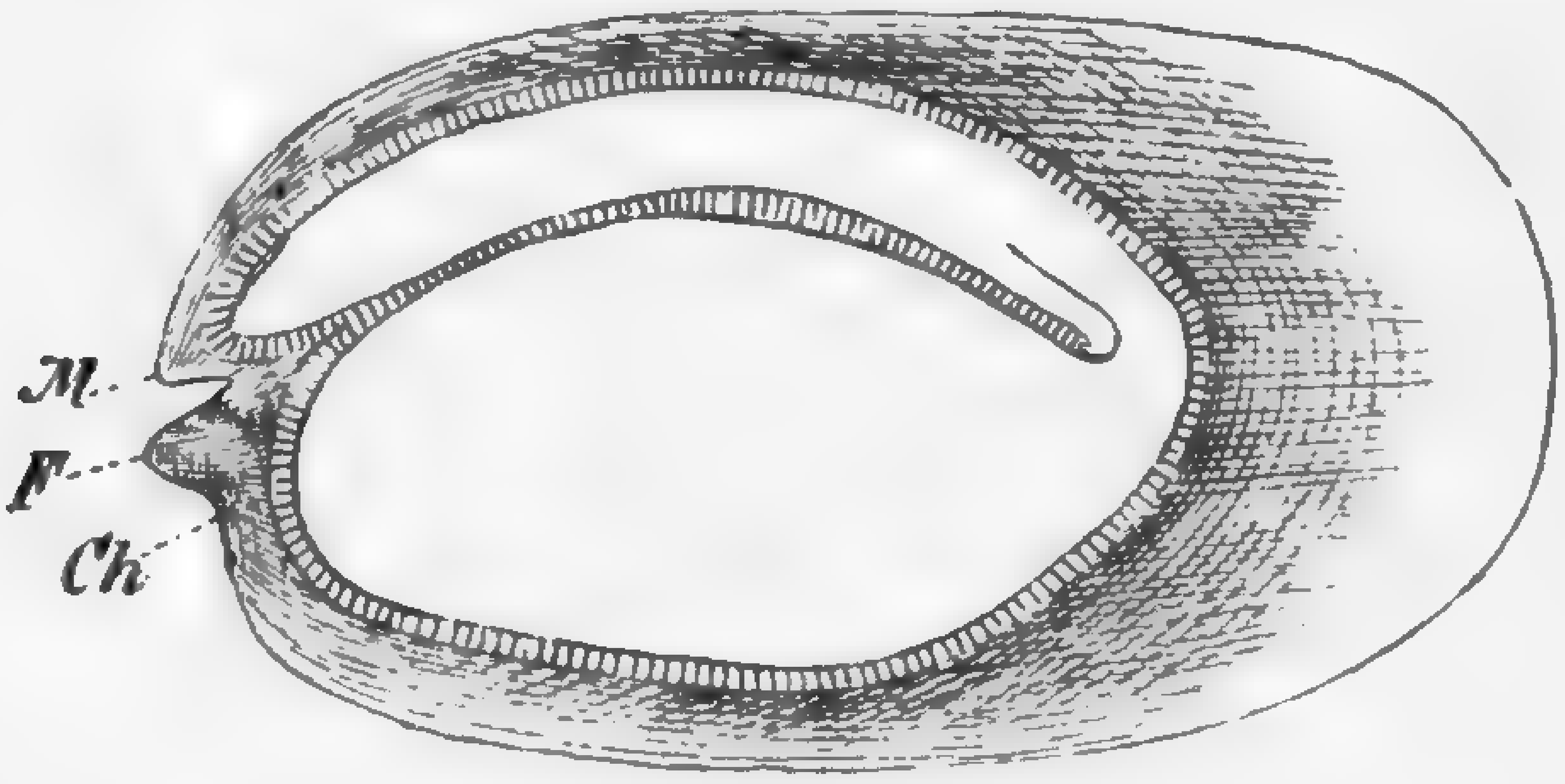


Fig. 91.



Figs. 90 and 91. Section of seed of *Cheiranthus Cheiri*, × 10.

of the Cruciferæ are based to some extent on this character, some groups being accumbent and some incumbent. I puzzled for some time over the reasons which could account for this differ-

ence, though the explanation which I would suggest is very simple when once stated. I have not, however, been as yet able to examine a sufficient number of cases to justify me in doing more than throwing it out as a suggestion.

Seen in section the two forms would be as shown in figs. 88 and 90. Now if from the form of the pods, or for any other reason, it is an advantage that the seed should be compressed, as in fig. 90, then, the thickness of the cotyledons remaining the same, it is better that the radicle should be accumbent; while, on the other hand, in a thicker or globular seed, as in fig. 88, the incumbent arrangement is most convenient. In fact we find that in groups, such as the Arabideæ, where the seeds are as a rule compressed, the radicle is almost always accumbent; while in incumbent groups, such as the Sisymbreæ, they are, on the contrary, more or less turgid. As an actual example of an incumbent form I give *Hesperis matronalis* (figs. 88 & 89), and of an accumbent, *Cheiranthus Cheiri* (figs. 90 & 91).

Petioles.

The cotyledons are sometimes sessile, as in *Acer* (fig. 9), *Hippophaë* (fig. 14), *Hakea* (fig. 21), *Clitorea* (fig. 27), sometimes supported on petioles, which in many cases, as in *Microloma* (fig. 29), attain a considerable length.

Occasionally we meet with both sessile and petioled cotyledons even within the limits of the same genus. For instance, *Delphinium Staphisagria* (fig. 31) has the cotyledons sessile, while those of *D. elatum* (fig. 30) have a petiole. In *Bryonia laciniosa* (fig. 92) the cotyledons are nearly sessile, while those of *B. dioica* (fig. 93) have petioles.

There is nothing, so far as I know, in the structure of the seed to account for this difference. It is observable, however, that while the cotyledons of *Bryonia laciniosa* (fig. 92) and those of *D. Staphisagria* (fig. 31) are raised by the caulicle somewhat above the level of the ground, those of *Bryonia dioica* (fig. 93) and of *D. elatum* (fig. 30) are attached close to the ground. In fact the cotyledons are carried up in both cases, but in *B. laciniosa* and *D. Staphisagria* by the caulicle or stalk of the plant, in *B. dioica* and in *D. elatum*, on the other hand, by their own petioles.

In short we may say that the cotyledons are, as a general rule, sessile when they are raised by the growth of the caulicle, while

they are petiolate when they take their origin close to the ground. There are no doubt some exceptions; for instance,

Fig. 92.

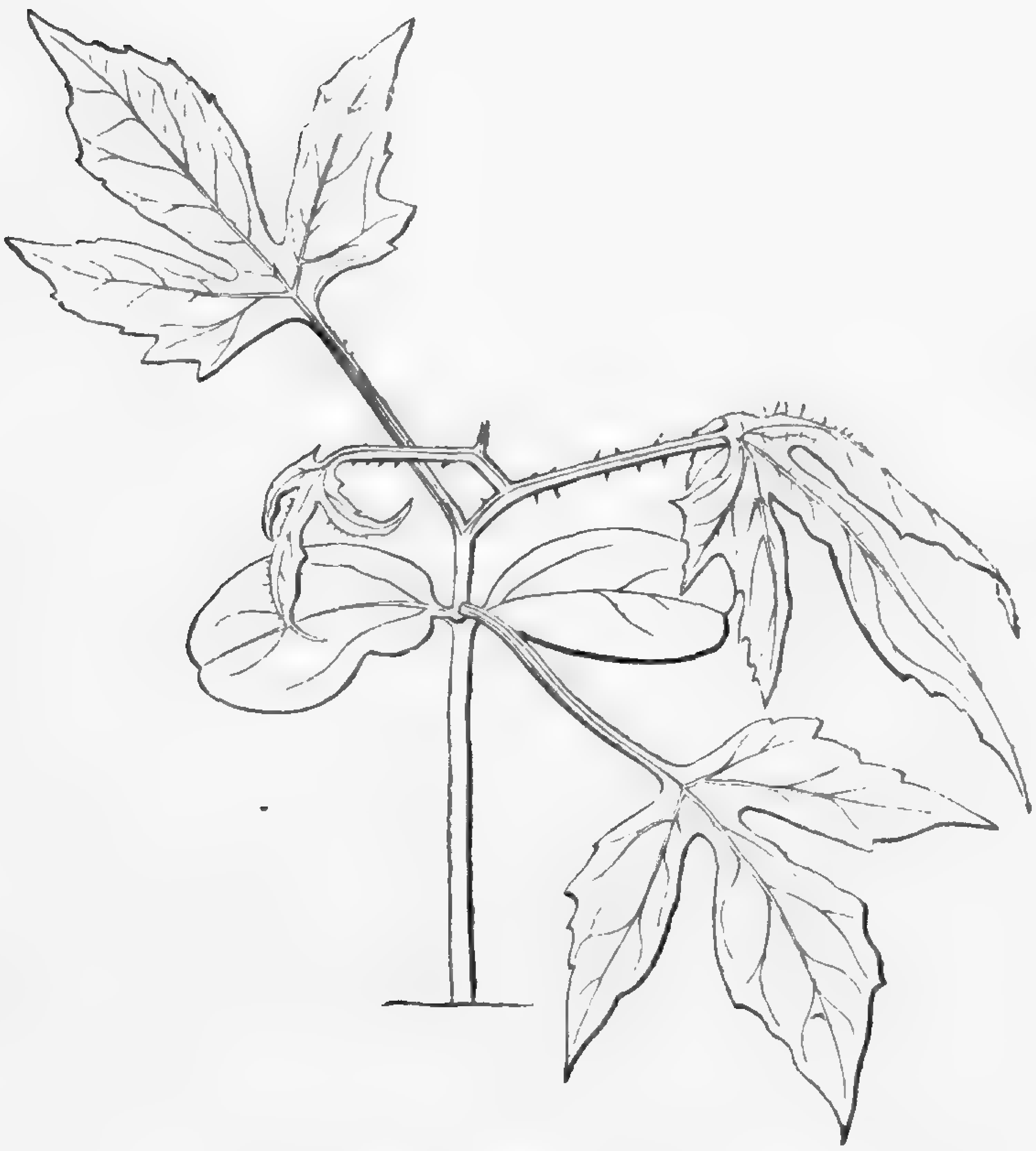


Fig. 93.

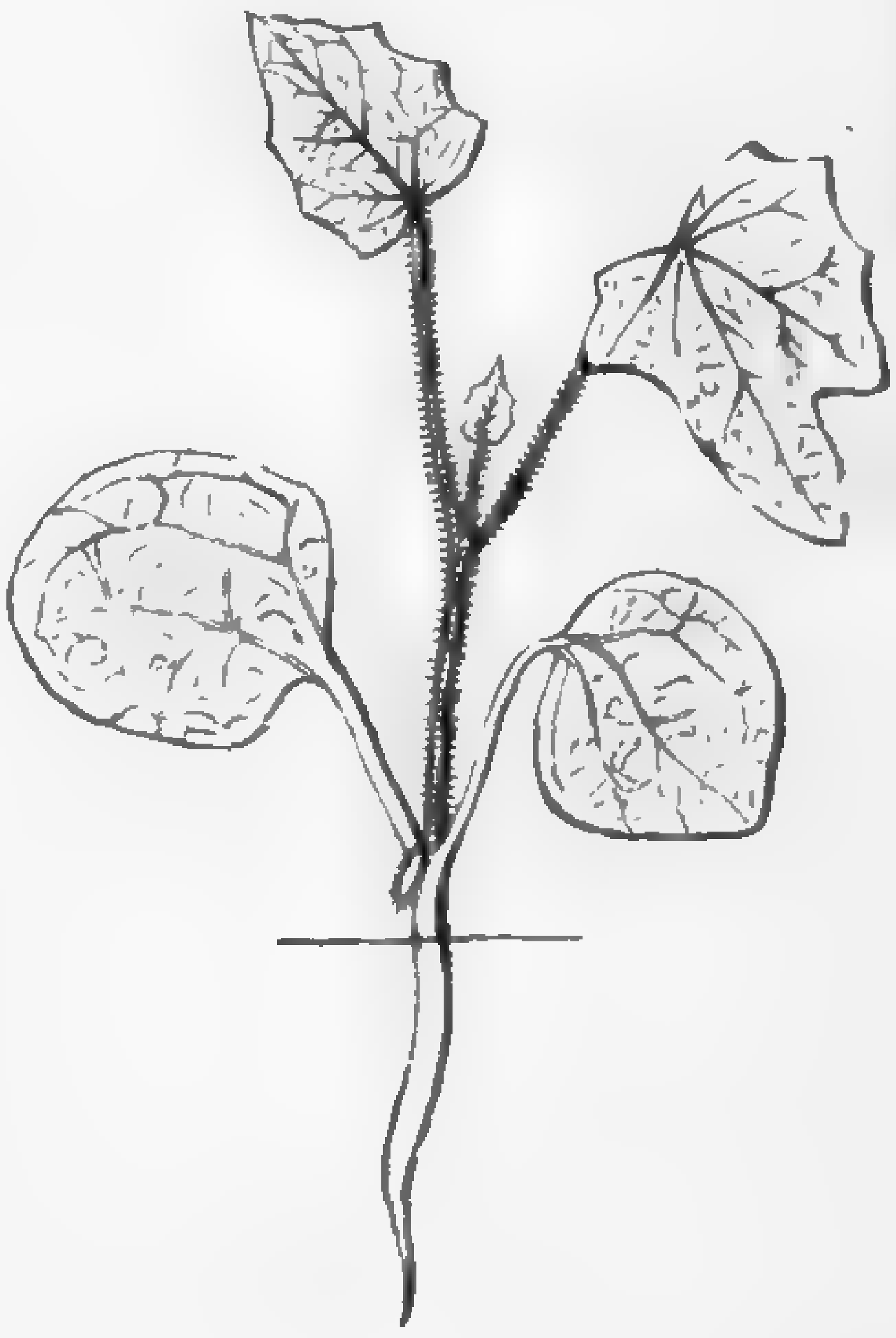


Fig. 92. Seedling of *Bryonia laciniosa*. Half nat. size.
Fig. 93. Seedling of *B. dioica*. Nat. size.

in some species of *Hedysarum* the cotyledons are radical and yet sessile. I have, however, often in Algeria seen seedlings of this group in hot exposed situations, where they "held the field" alone, and being sure of ample heat and light, did not require to be raised above the surface.

The opposite exception is perhaps more common—*i. e.* when the cotyledons, though raised, are still petiolate. Here, however, the cotyledons are probably petiolate for the same reason as the leaves—viz., when the foliage is large, leaf-stalks are an advantage in carrying the lower leaves out of the shadow of those immediately above them.

In another species of *Delphinium* (*D. nudicaule*, fig. 32) the cotyledons are raised well above the surface of the ground on a stem consisting of their own two stalks or petioles, which are connate, though readily separable from one another. Connate cotyledons

also occur in *Phlomis tuberosa*, *Smyrnium perfoliatum*, *Polygonum Bistorta* *, &c. Gray † observes that the economy of this arrangement is not apparent. Assuming, however, that the elevation of the cotyledons is an advantage, perhaps, as I have suggested, from carrying them above the surrounding herbage, the combination of the two petioles—reversing the old fable of the bundle of sticks—would, with the same amount of material, give a considerable addition of strength.

In other cases, however, the existence of petioles apparently has reference to the arrangement of the embryo in the seed.

In the Geraniums, for instance, as has been already mentioned, the cotyledons are folded on themselves, one half of each lying within the other. Fig. 94 represents an embryo partially unfolded, and it will be seen that in the position assumed by the cotyledons the petioles are necessarily as long as half their breadth. In *Eucalyptus Globulus*, again (fig. 112), the mode of folding of the cotyledons would be impossible but for the petioles.

Fig. 94.

Germinating seedling of *Geranium bohemicum*, × 6.

* Winkler, "Ueber die Keimblätter der deutschen Dicotylen," Brandenburg Bot. Ver. 1874.

† 'Structural Botany,' p. 21.

Lastly, in cases where the cotyledons do not leave the seed, the petioles leave room for the free growth of the plumule, as in *Sapindus* (fig. 43).

Lobed Cotyledons.

The great majority of cotyledons are entire, but some are more or less lobed. For instance, those of the Mallow (fig. 35) are broadly ovate, minutely emarginate, cordate at the base, and 3-lobed or angled towards the apex, with three veins, each running into one of the lobes.

Those of *Lavatera* and *Althæa* are similar. The embryo is green, curved, and occupies a great part of the seed. The cotyledons are applied face to face, then, as growth continues, the tip becomes curved, and depressed into a median longitudinal furrow, the fold of the one lying in that of the other.

The embryo is a small body of the form shown in fig. 95: the horn or process *r* is the radicle; the rest is the cotyledon, of which the free end *f* is folded on itself and turned downwards. In this way the embryo occupies the seed, leaving a small space between the cotyledons and also between *f* and *r* which is occupied by perisperm. Perhaps it may make the arrangement clearer to take a piece of note-paper, cut it into the form of an egg

Fig. 95.

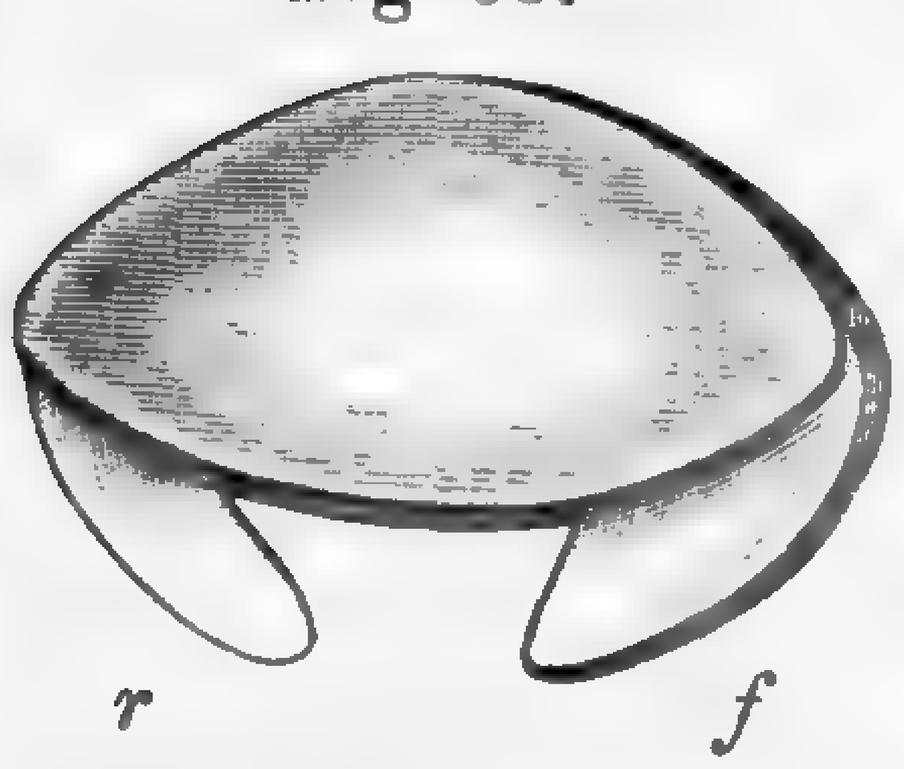


Fig. 96.

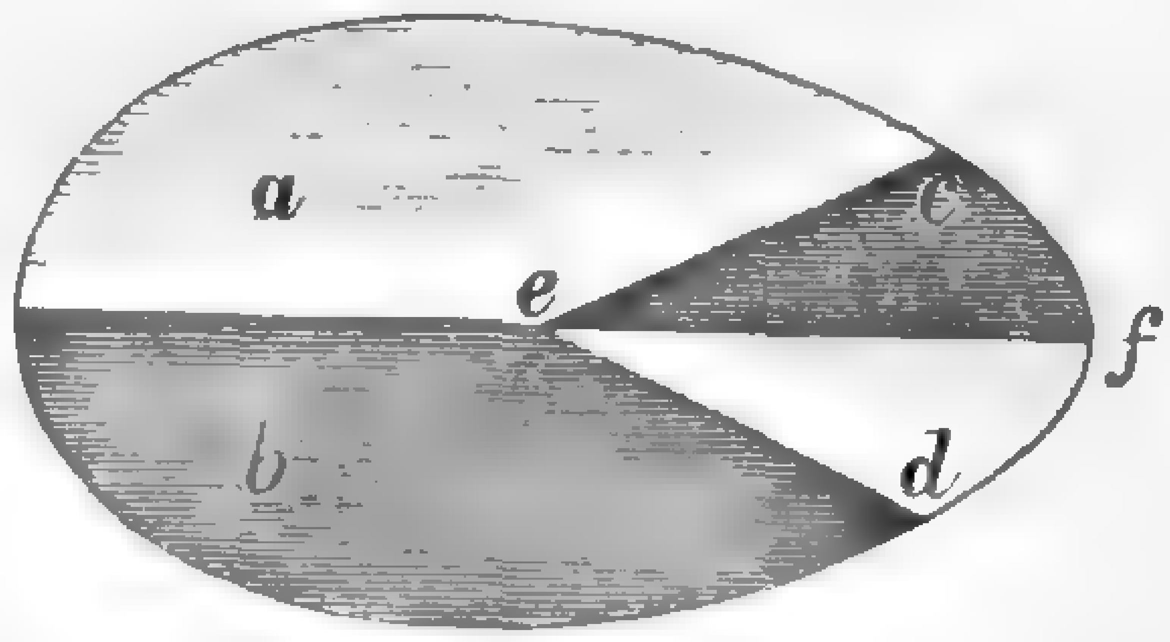


Fig. 97.

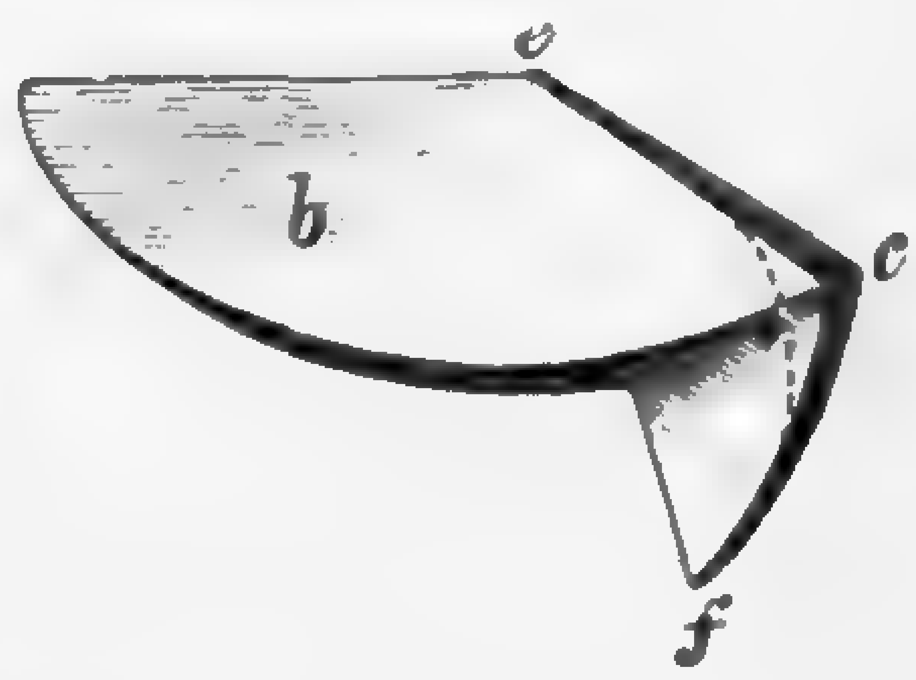


Fig. 95. Embryo of Mallow. Enlarged.
Figs. 96 & 97. Piece of paper prepared to show the mode and effect of the folding of the embryo.

(fig. 96), turn the broad portion *a b* downwards, so that the parts *a* and *b* have their under faces turned to one another, and then press down the line *e f*, and bring the points *c* and *d* together, so that *c e f* and *d e f* have their upper surfaces together, and the apex *f* pointing downwards. We shall then have an object shaped as in fig. 97, with a sharp point at *c*, which would not conform to the rounded shape of the seed. If, now, to make it do so, we cut off the point *c* along the dotted line and then unfold the paper, we shall find that it has the form of the cotyledon of *Malva* (fig. 35) with a bay or notch on each side. In *Erodium* the arrangement is somewhat similar, and it seems

clear that the lobes are due to the manner in which the embryo is folded.

In *Œnothera* and some allied species the cotyledons also present a terminal lobe. This, however, is not due to folding. The terminal lobe is the original cotyledon, and the basal portion is altogether subsequent growth, which moreover, to some extent, assumes the character of the true leaf. I shall refer to this interesting group in more detail on a subsequent occasion.

The case of *Petiveria octandra* (fig. 81) has been already described.

Emarginate Cotyledons.

In a great many species the cotyledons are emarginate, or even more or less deeply bifid. No explanation of this has, so far as I know, yet been offered. It is, in fact, as I shall hope to show, by no means always due to the same cause.

One of the simplest cases is that of the Oak, where the thick fleshy embryo occupies the whole of the seed. The chalaza is situated at the centre of one end, at the extremity of the cotyledons, and the walls of the seed being at that point somewhat thickened, the cotyledons are slightly pressed in. The same explanation applies to various other species, as for instance to the *Impatiens* (figs. 12 and 98), *Poterium* (figs. 42 and 99), *Cuphea* (fig. 100), and Nettle (*Urtica*, fig. 101).

Fig. 98.

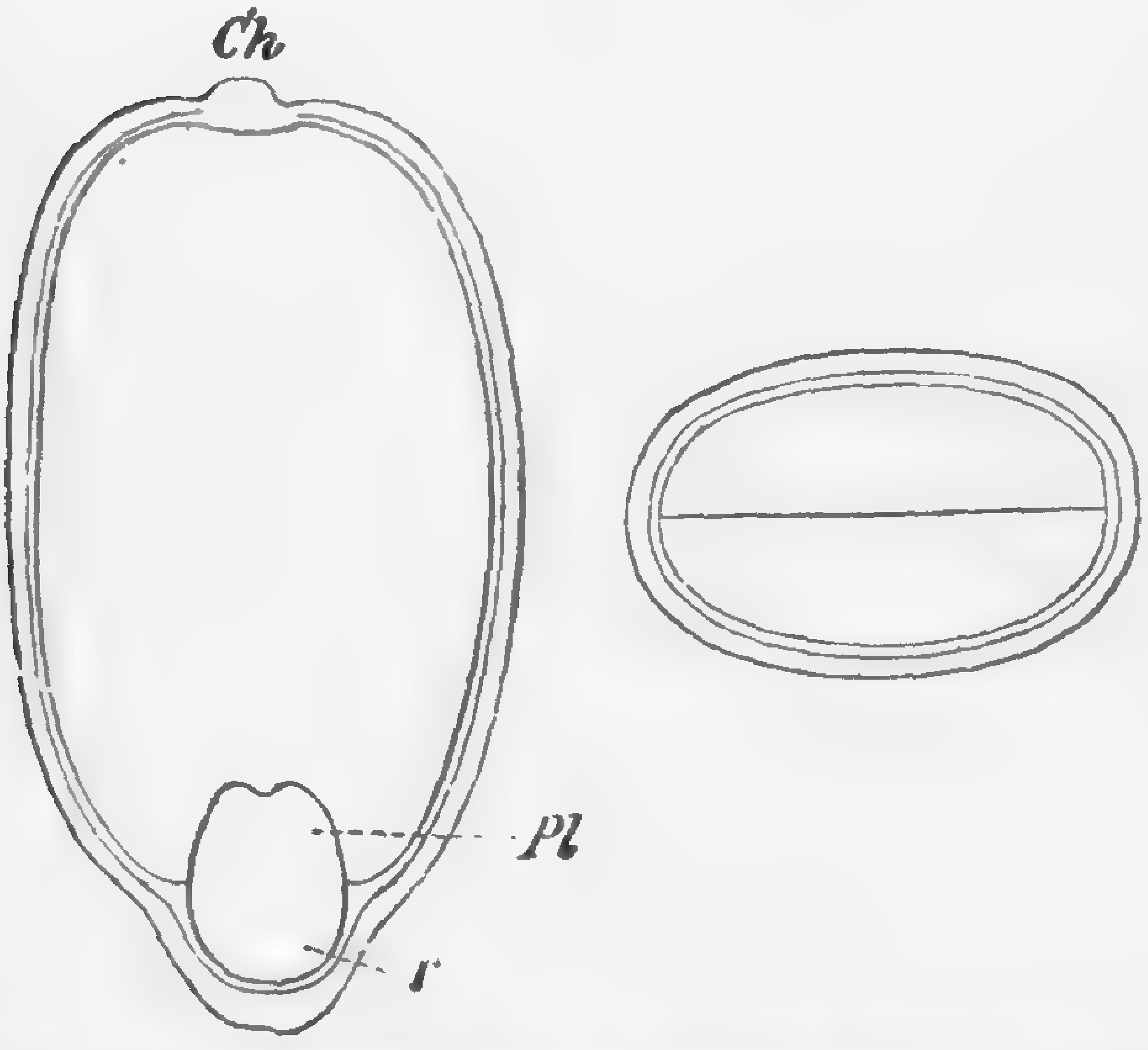


Fig. 99.

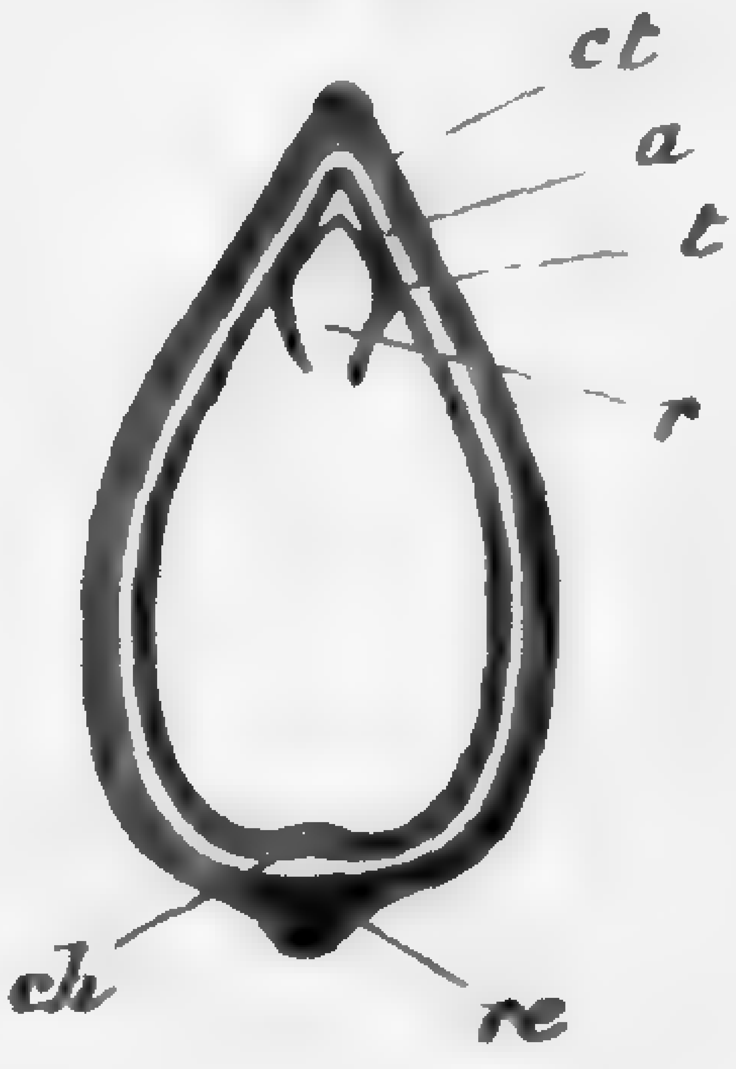


Fig. 98. Longitudinal and transverse sections of seed of *Impatiens parviflora*, × 10. *Pl*, Plumule.

Fig. 99. Longitudinal section of *Poterium Sanguisorba*, × 9. *ct*, calyx-tube; *a*, achene; *re*, receptacle.

In *Helianthus Cucumis* the seed itself is slightly notched at the point where it articulates with the receptacle; and the cotyledons, which, with the rest of the embryo, eventually occupy the whole interior of the seed, conform to this notch.

In such cases as the Mustard (fig. 3), Cabbage, and Radish, the emargination is due to a totally different cause. The seed (fig. 74) is oblong, thick, and slightly narrower at one end than the other. There is no perisperm, so that the embryo occupies the whole

Fig. 100.

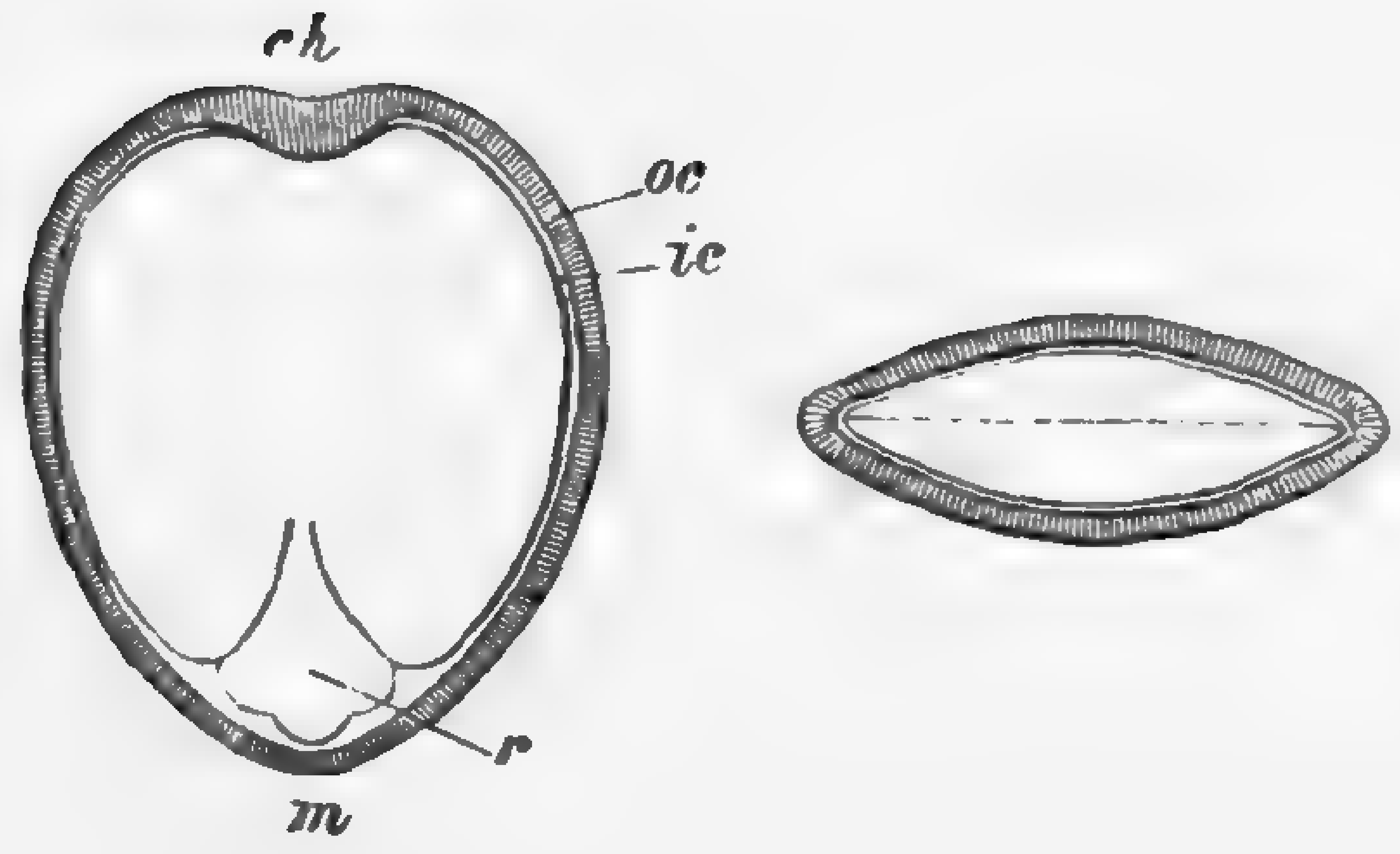


Fig. 101.

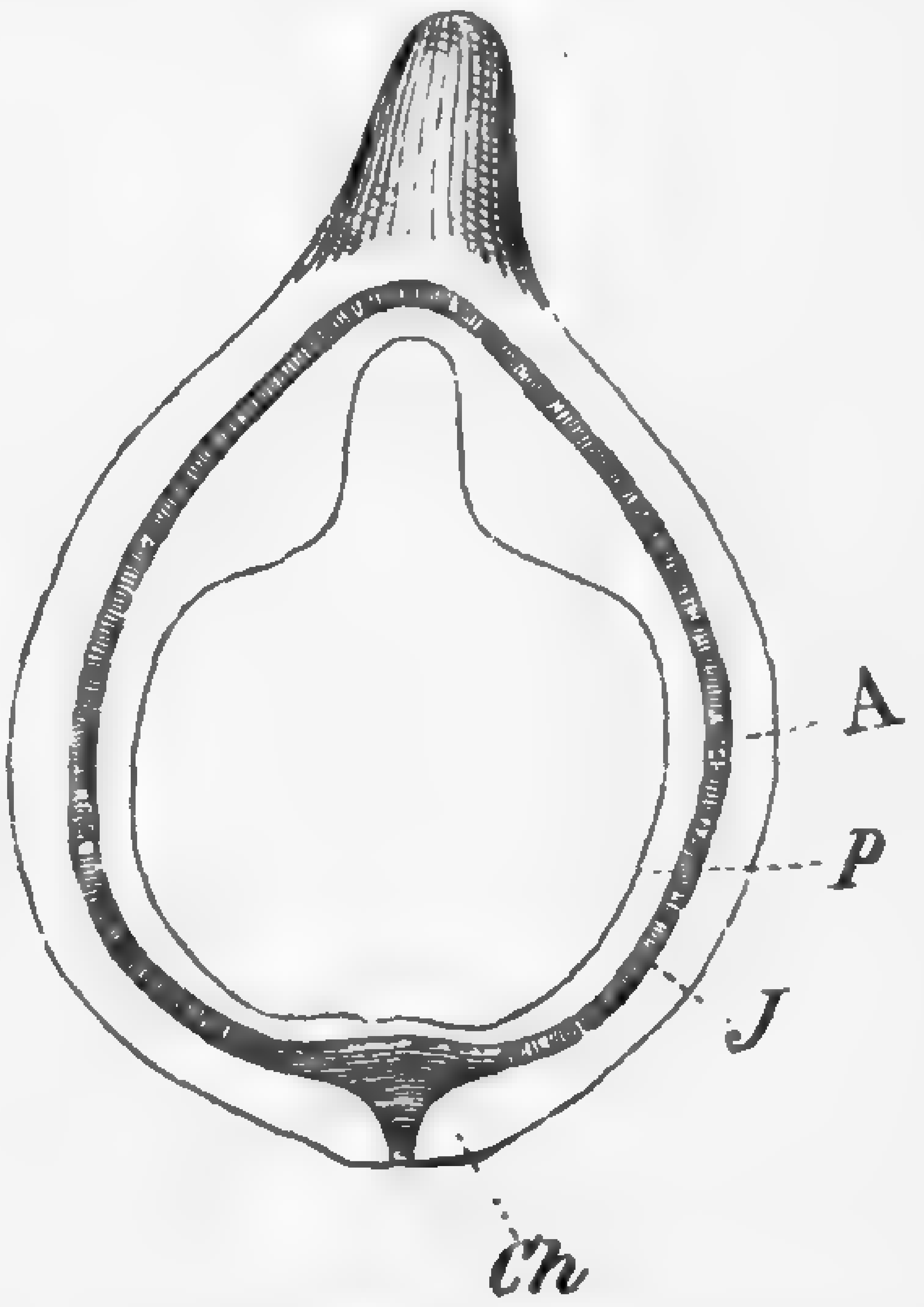


Fig. 100. Longitudinal and transverse sections of *Cuphea silenoides*, × 10. *oc*, outer coat of testa; *ic*, inner coat of testa.

Fig. 101. Achene of Nettle (*Urtica dioica*), × 30. J, testa.

seed and as this is somewhat deep, the cotyledons, in order to occupy the whole space, are folded and arranged one over the other, like two sheets of note-paper, as shown in figs. 75–78, the radicle being folded along the edge. Fig. 77 represents the seed a little opened out; and fig. 76 a section showing the radicle and the outer and inner cotyledons. To this folding the emargination is due. If a piece of paper be taken, folded on itself, cut into the form shown in fig. 74, with the fold along the edge from *m* to *h*, and then unfolded, the reason for the form of the cotyledon becomes clear at once. *Zilla myagroides* affords a similar case.

But it may be said that in the Wallflower the seed has a similar outline, and yet (fig. 102) the cotyledons are not emarginate. The reason of this is that in the Wallflower, *Cheiranthus* (figs. 90, 91), the seed is more compressed than in the Mustard and Radish (figs. 75, 76), and consequently the cotyledons are not folded; so that the whole, not the half, of each cotyledon corresponds to the form of the seed.

In the Bignoniaceæ, again, a large number of species have emarginate cotyledons; and this would appear also, as for instance in *Pithecoctenium Aubletii*, to be due to the chalaza, though in a different manner. The seeds themselves are transversely oblong, much compressed dorsally, surrounded on all sides except the base by an extremely thin, transparent, membranous wing, which is traversed by nerves radiating from the central part of the seed,

Fig. 102.

Seedling of *Cheiranthus Cheiri*. Two thirds nat. size.

and is uneven at the margin. The raphe is ventral, extending from the hilum to the centre of the embryo. The chalaza is attached to the embryo-sac a little above the middle of the embryo. The radicle is very small, distant from, but pointing to, the hilum. The embryo is straight and flat; the cotyledons grow until they come to the point of attachment of the chalaza, when they extend forwards on each side, forming two lobes.

In *Oroxylum indicum* the general structure of the seed is very similar, but the growth of the two lobes of the cotyledons is even more luxuriant, so that they actually overlap. A structure more or less similar occurs in other genera of this family.

The emargination is very much deeper in other groups, and due to other conditions, for instance in the Convolvulaceæ. In *Convolvulus Soldanella* (fig. 103) the embryo, which is eventually very large, lies at first straight in the seed embedded in a clear jelly-like perisperm, and rests on a solid, ovate, grooved, white ridge (figs. 104 and 105, *a*), which rises from close to the micropyle. This tongue-like ridge grows with the embryo. At the opposite end of the seed the raphe and chalaza form a somewhat pro-

minent ridge (*b*) projecting into the perisperm. The cotyledons in this stage are plano-convex, applied face to face, orbicular, entire, green, with distinct petioles, 5-nerved, with two lateral, subopposite branches from the midrib some distance below the apex. The plumule and radicle are small. The cotyledons

Fig. 103.

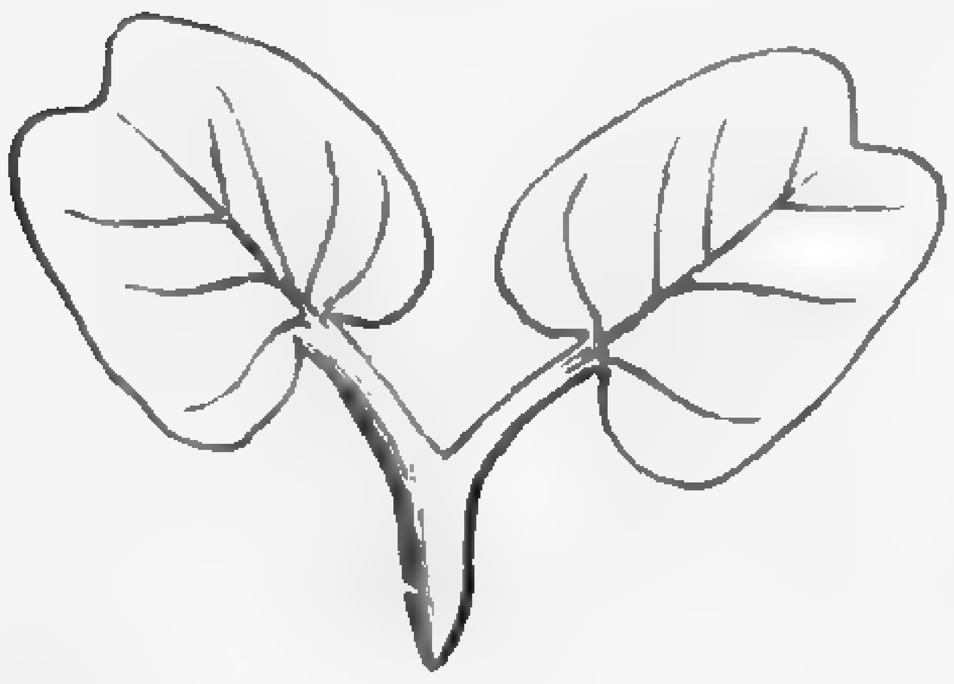


Fig. 104.

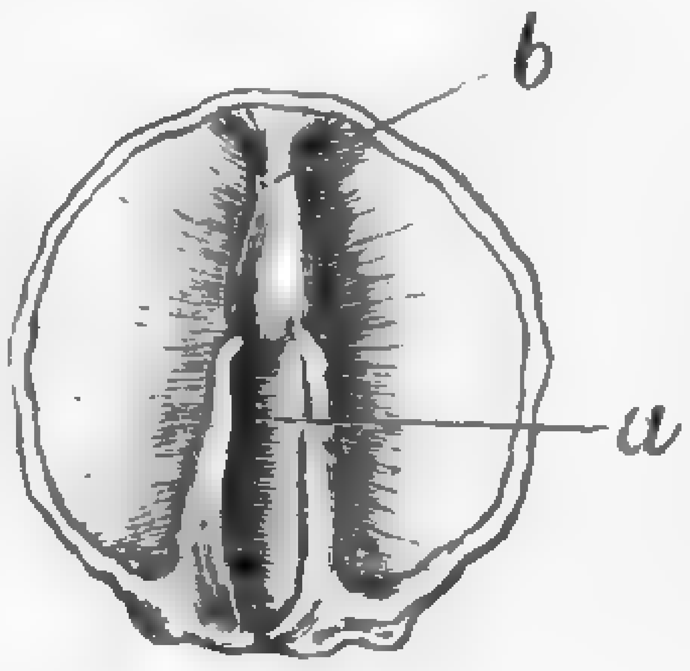
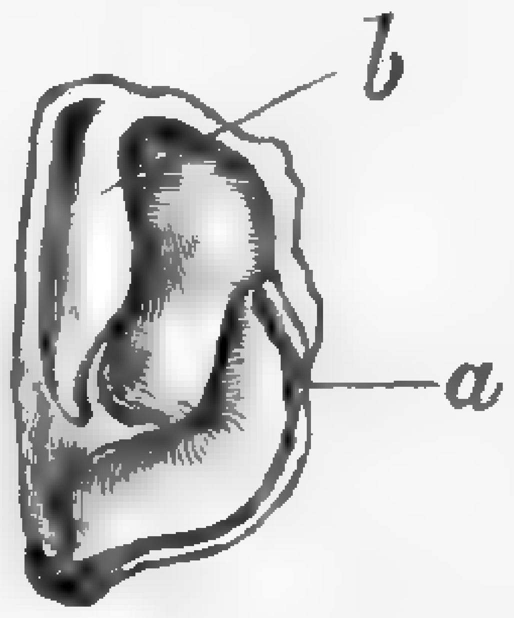


Fig. 105.



Convolvulus Soldanella.

Fig. 103. Embryo, × 2. Fig. 104. Section of seed after removal of the dorsal surface, embryo, and perisperm, × 2. Fig. 105. Side view of ditto, × 2.

gradually increase in size and grow over the process in which the radicle (*a*) lies, extending to the apex of the seed, doubling over and abutting against the ridge formed by the raphe and chalaza (*b*), and thus becoming more and more emarginate at the apex. The notch is therefore due to their continuing to grow at the sides after their apex has reached this ridge.

In *Ipomæa purpurea* (figs. 106–108), where the seed is con-

Fig. 106.

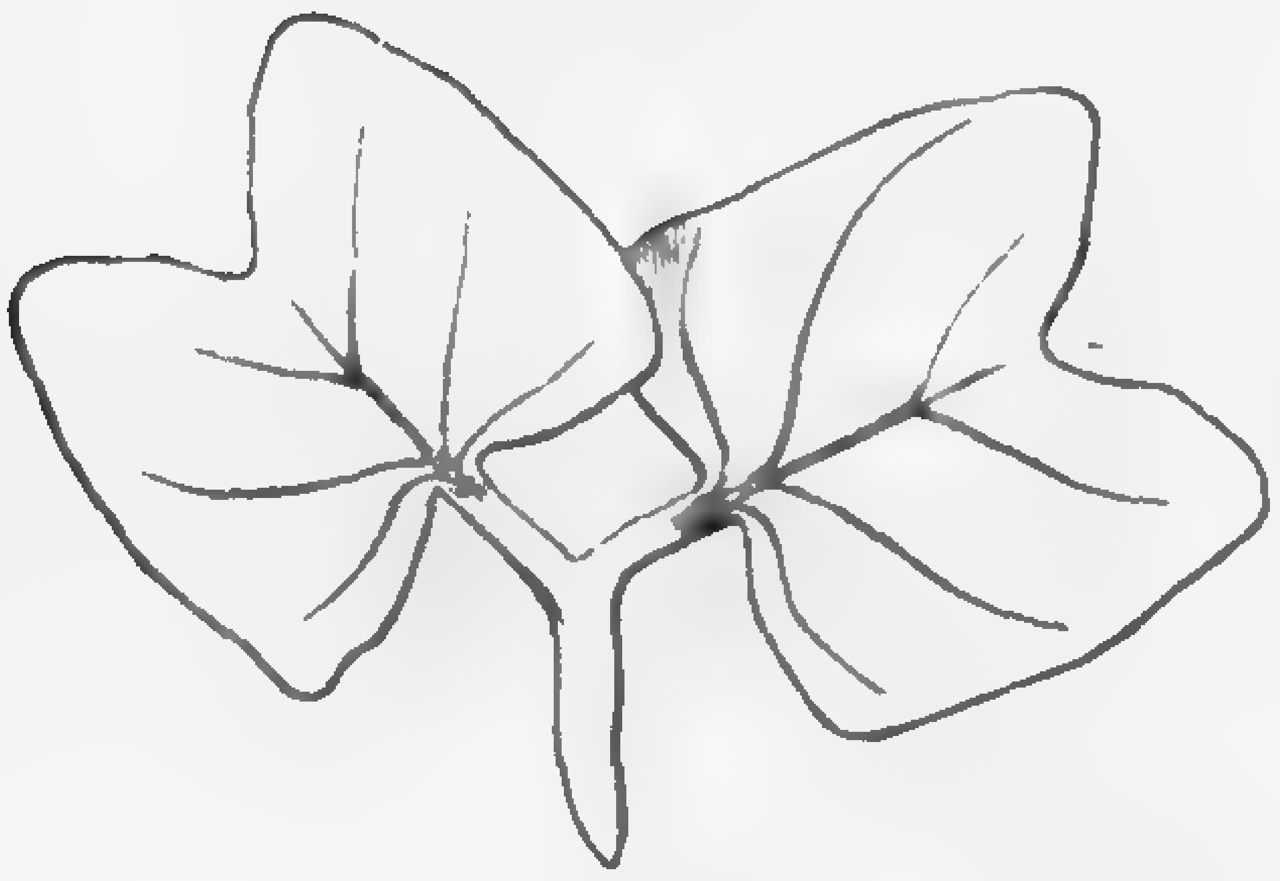


Fig. 107.

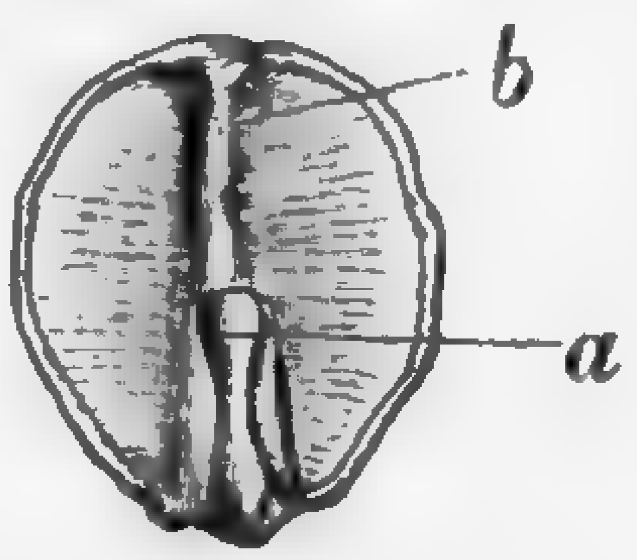
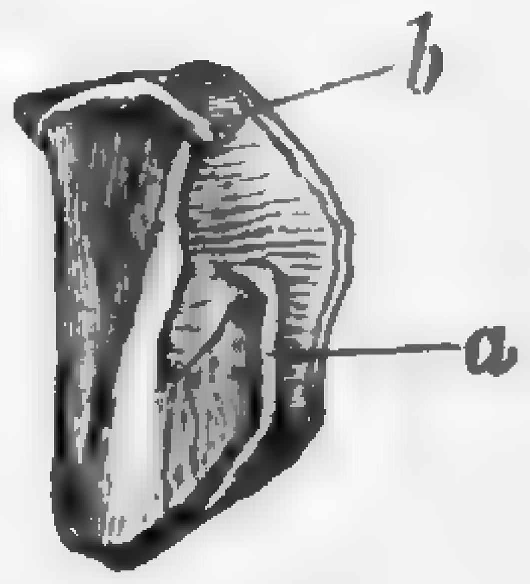


Fig. 108.



Ipomæa purpurea.

Fig. 106. Embryo, × 2. Fig. 107. Section of seed after removal of dorsal surface, embryo, and perisperm, × 2. Fig. 108. Side view of ditto, × 2.

structed generally on the same model as in *Convolvulus Soldanella*, the ridge formed by the raphe and chalaza (figs. 107 & 108, *b*), is more prominent, and consequently the notch of the cotyledon is deeper. Lastly, in *Ipomæa dasysperma* (figs. 109–111) the projecting ridge of the chalaza is still more developed and grows nearly to the process which supports the radicle; the cotyledons

are thus precluded from growing in length, and in consequence send out two long wings, so that they are divided almost to the base (fig. 111).

In *Shorea*, again, the division of the cotyledons appears to be due to an internal process of the seed. I have not, however, had an opportunity of examining a specimen.

Fig. 109.

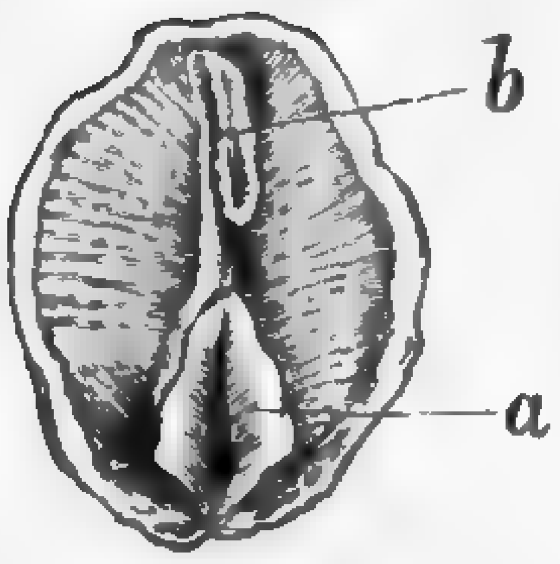


Fig. 110.

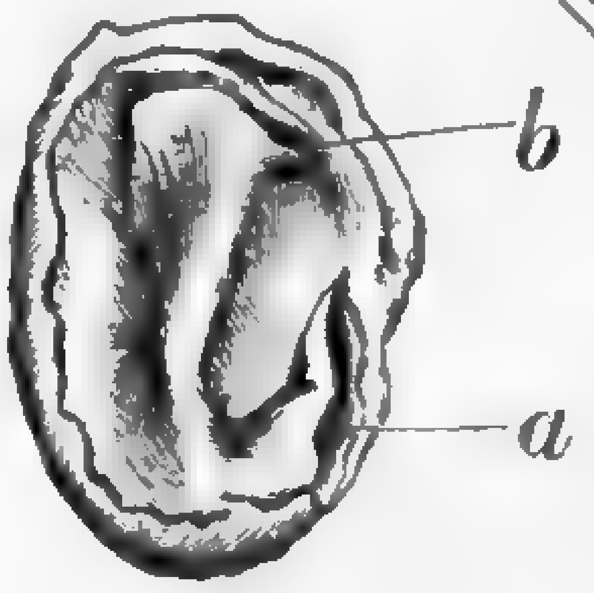


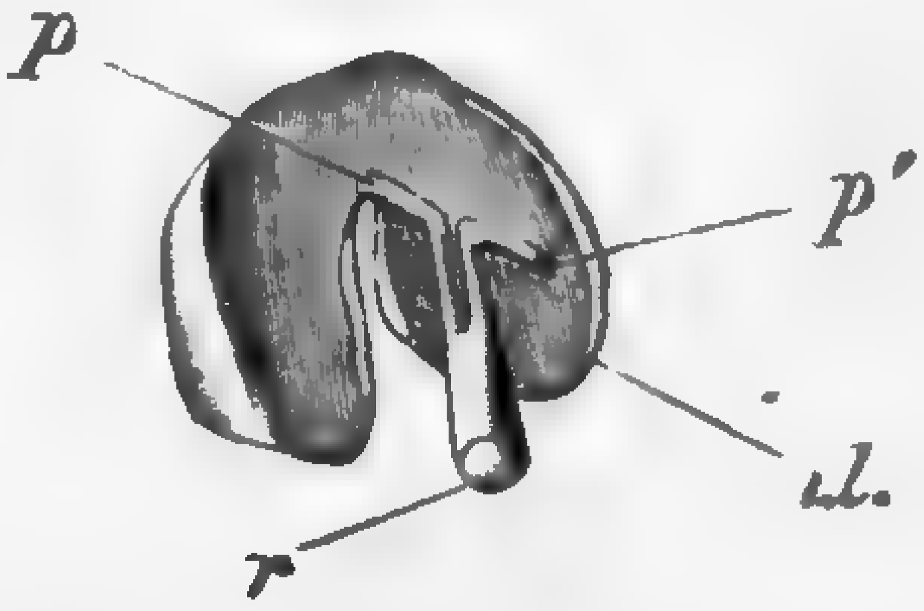
Fig. 111.

Ipomœa dasysperma.

Fig. 109. Embryo, × 2. Fig. 110. Section of seed after removal of dorsal surface, embryo, and perisperm, × 2. Fig. 111. Side view of ditto, × 2.

In *Eucalyptus* (fig. 38) we have a different case. The embryo is (with the exception of the petioles) straight or nearly so, fleshy, white, occupying the whole of the seed, and conforming to it in general outline; the cotyledons are deflexed and convolute round the radicle, which the lobes equal in length, while half of

Fig. 112.



Embryo of *Eucalyptus Globulus*, one cotyledon being cut away. *p*, petiole; *p'*, cut end of petiole; *i.l*, inner lobe of cotyledon. ×4.

one cotyledon lies over half the other; one half of each consequently lying against the testa. The radicle is stout, fleshy, truncate at the end where it lies against the testa, but otherwise entirely enclosed by the folded cotyledons. The true length of the cotyledon is determined by the distance between the end of the petiole and the opposite pole of the seed. The side of the cotyledons, however, being folded back, that part which lies beyond the petioles is enabled by folding round the radicle to widen, and this consequently gives the cotyledons their more or less pronounced hourglass shape.

Moreover, in speaking of emarginate cotyledons, we must distinguish between two very opposite cases, of which I may take *Galium Aparine* and *Œnothera Lindleyana* as illustrations. In the former the cotyledons commence with an entire end (fig. 113), and subsequently, not as a rule till they have left the seed, become

Fig. 113.

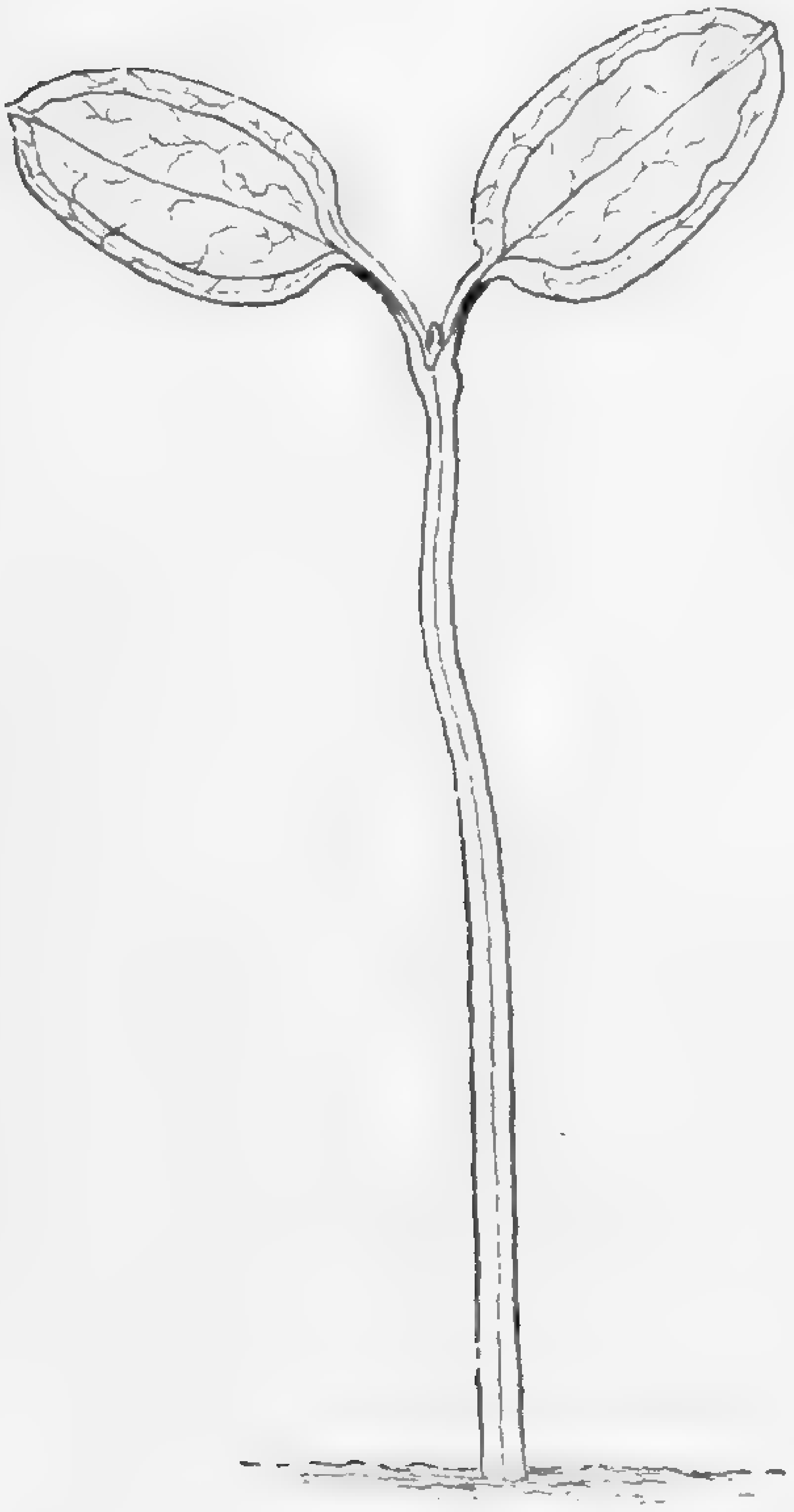


Fig. 114.

Fig. 113. Young seedling of *Galium Aparine*, ×2.
Fig. 114. Ditto, a few days older, ×2.

emarginate (fig. 114); in *Œnothera Lindleyana*, on the contrary, the cotyledons are at first emarginate, but gradually cease to be so. The embryo gradually appropriates all the perisperm, but the supply being largest at the wider end of the seed, this is the last part to be absorbed. In neither of these cases does the emargination appear to be directly due to the structure of the seed, nor to be in itself of any advantage to the plant. It seems rather to depend on the conditions of growth. In *G. Aparine* the cotyledon terminates in a peculiar gland*, which would

* This gland has already been mentioned by Gravis in his work on *Urtica dioica*, p. 139. He observes that about a dozen small stomata occur on it, while they are entirely absent on the rest of the upper surface. He regards it as a water-gland, " un organ destiné à remédier à l'excès de tension dans l'appareil aquifère."

appear in this and other cases, after the emergence of the cotyledon, to stop its growth at that point, and thus to produce the emargination.

In *Senecio*, again, the majority of species have entire cotyledons. In some, however, as in *S. erucæfolius*, they are emarginate. Even here, however, they are at first entire (fig. 115), and the emargination does not make its appearance until after germination, when the cotyledons gradually become much widened (fig. 116). In fact, *Senecio squalidus*, *S. viscosus*, *S. vulgaris*,

Fig. 115.

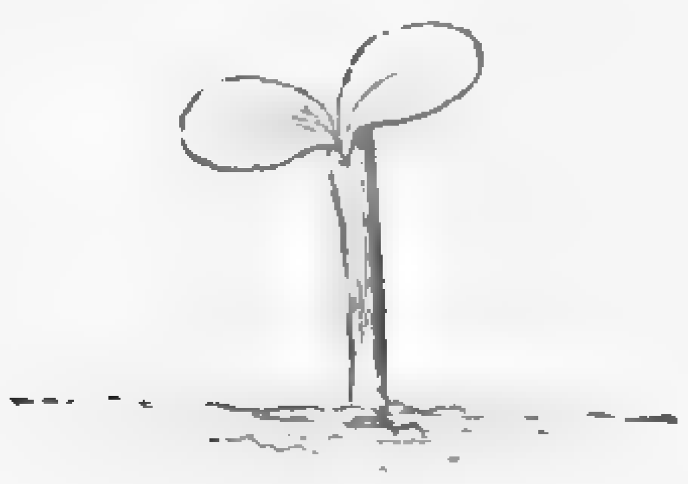


Fig. 116.

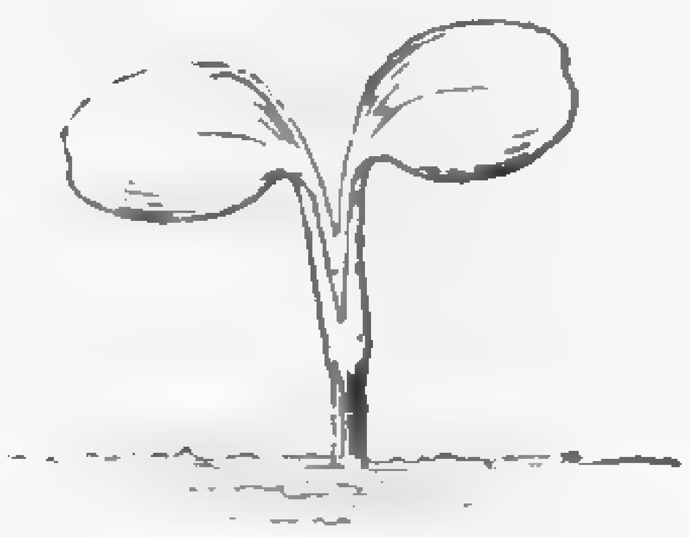


Fig. 115. Young seedling of *Senecio erucæfolius*.
Fig. 116. Ditto, a few days older.

&c. have the cotyledons narrow and entire; while in *S. erucæfolius* and *S. Cruentus*, where they grow more in width than in length, they become emarginate. Among other cases where the cotyledons are at first entire, but after germination become emarginate, may be mentioned some species of *Lithospermum*.

Bryonia laciniosa (fig. 92) also has the cotyledons emarginate, while in *Bryonia dioica* (fig. 93) they are entire. They are, however, originally entire in both cases, and the emargination in *B. laciniosa* is due to the fact that in that species the cotyledons grow much more than in *B. dioica*. There is no great difference in size between the seeds, those of *B. laciniosa* being perhaps one tenth larger. On the other hand, the cotyledons of *B. laciniosa* attain a length three times greater than those of *B. dioica*, as shown in the figures (figs. 92 & 93). In the genus *Tacsonia*, again, the cotyledons are entire in *T. Van-Volxemi* and *T. Leschenaultii*, and emarginate in *T. ignea*. Here also, however, they are at first entire, and only become emarginate after leaving the seed.

Divided Cotyledons.

The genus *Pterocarya* has very curious cotyledons (fig. 41), due to a cause entirely different from any of those we have considered hitherto.

They are bipartite, each primary division narrowing to a cuneate base, and being again deeply divided, so as to make in all four ultimate, linear, oblong, obtuse, entire segments. In this case the endocarp is thickened, bony, and divided at the base into four cells (fig. 117, *c c c c*) by the thickening and consequent intrusion of the dorsal and ventral walls.

The seed (fig. 118) is conical above, deeply 4-lobed below (fig. 118, *l l l l*), one lobe (*l*) passing into each of these cells (*c*). The embryo again follows suit, and each cotyledon sends a lobe into each of the four cells, thus assuming the peculiar form characteristic of the species.

Fig. 117.

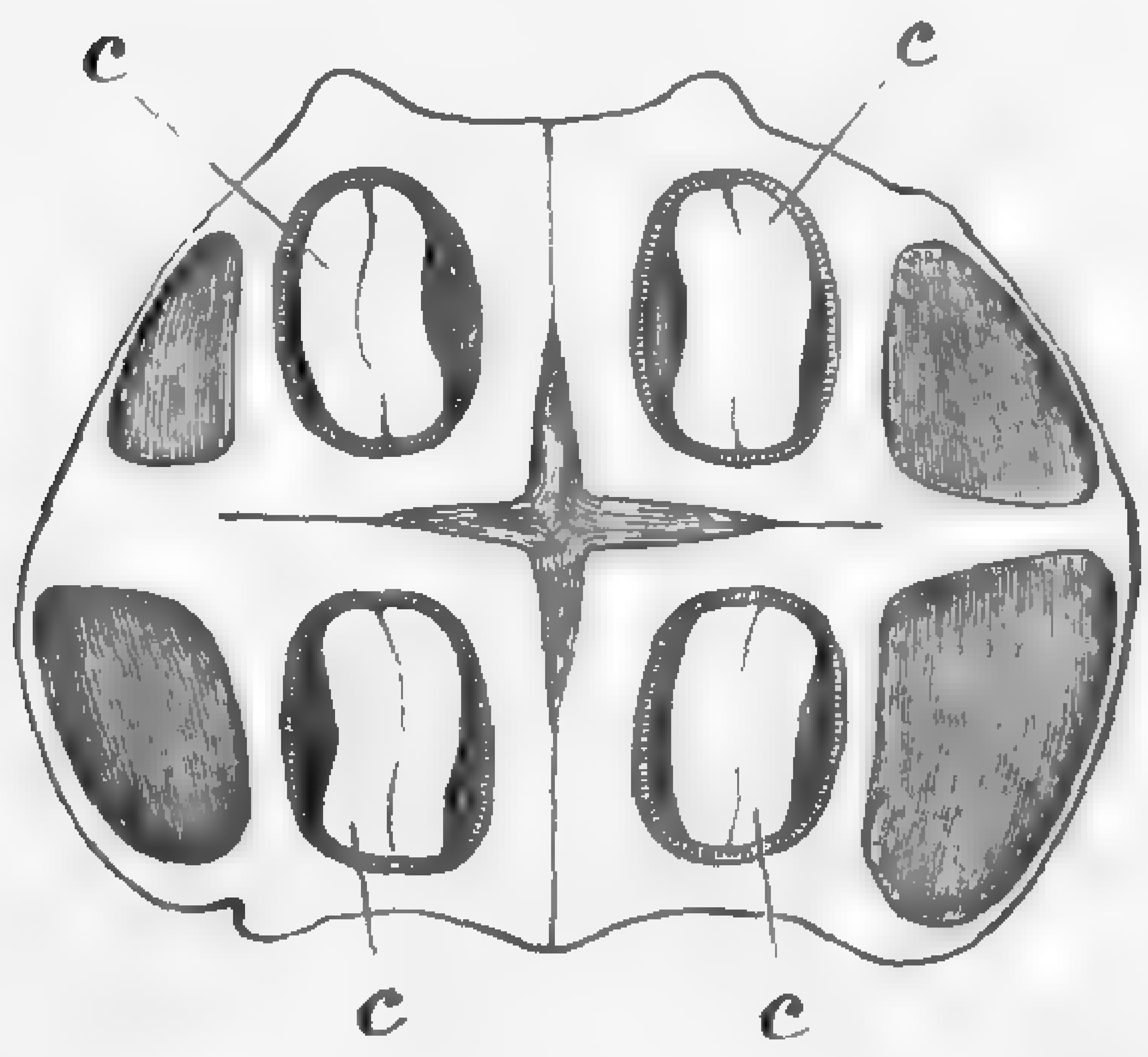
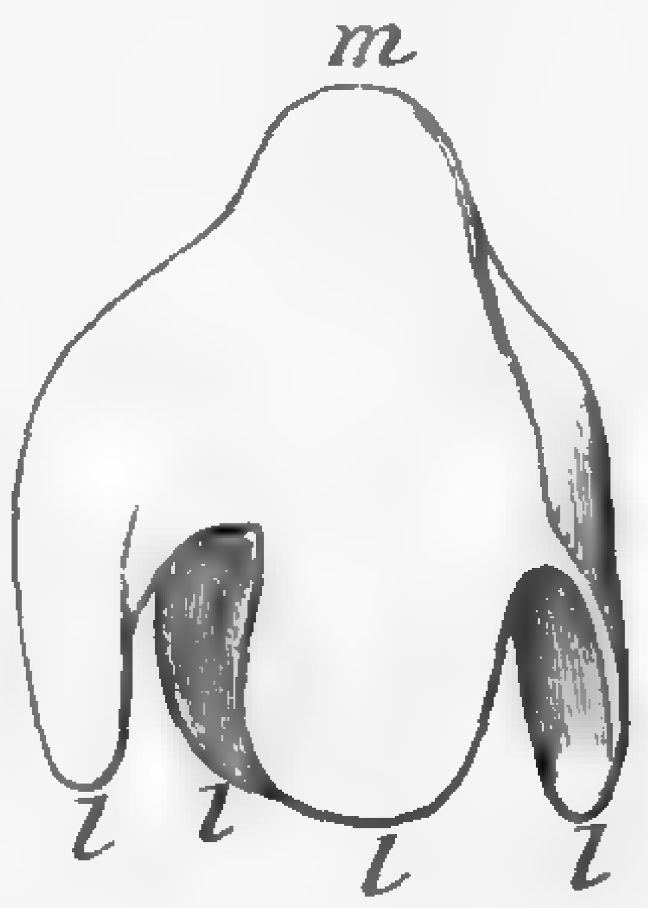


Fig. 118.



Pterocarya caucasica.

Fig. 117. Transverse section of nut, × 6.
Fig. 118. Transverse section of seed, × 6.

In *Eschscholtzia* (fig. 40) the cotyledons are deeply bifid, resembling a hay-fork with two long prongs. In this case we find no such peculiarity of the fruit or seed to account for the peculiarity. My first idea was that such cases might possibly be due to some difference in the perisperm, as occurs in certain Umbellifers, *Delphinium*, &c., and which might have permitted growth more readily in certain directions than in others. Thin sections, however, showed no such differences. Moreover, *Schizopetalon Walkeri* (one of the Cruciferæ) (figs. 120–123) has the cotyledons as deeply divided as in *Eschscholtzia*; and as there is no perisperm, but the embryo occupies the whole seed, within which the long lobes of the cotyledons wind about more or less irregularly, the division cannot be due to differences in the perisperm. There are, moreover, other species, such as the Sycamore (fig. 52) and Hop, where the cotyledons are also narrow, winding, and occupy the

whole seed, but are not divided. We must therefore seek some other explanation, and I will suggest the following.

In most of the species which I have examined, when the cotyledons remain in the seed they do not leave the ground. In some cases, however, as in *Anona* (fig. 119), the caulicle is long, stout, and rises in the form of a loop during germination, while the cotyledons, which at first are very small, gradually increase almost to the length and breadth of the seed, throw themselves into undulations, and it being perhaps on this account impossible to withdraw themselves from the seed, are eventually torn from the axis. In *Bignonia insignis*, again, the cotyledons, though flat and leaflike, are unable to emerge from, or at any rate do not emerge from, the seed. This may possibly give us a clue to such cases as *Eschscholtzia* and *Schizopetalon*, which, I would venture to suggest, may have reference to the manner in which the cotyledons free themselves from the seed. If this is delayed, the young plant suffers considerably, and indeed often perishes. That the process is not, however, so simple as might be imagined, may be seen from the interesting case afforded by the Cucurbitaceæ, where, in Mr. Darwin's words*, "the seed-coats are ruptured by a curious contrivance, described by M. Flahaut. A keel or peg is developed on one side of the summit of the radicle or base of the hypocotyl, and this holds down the lower half of the seed-coats (the radicle being fixed into the ground), whilst the continued growth of the arched hypocotyl forces upwards the upper half,

Fig. 119.

Germinating seedling of *Anona*.

* 'Movements of Plants,' p. 102. In *Welwitschia* Bower has pointed out that a corresponding process serves to absorb the perisperm, acting in fact as a feeder to the young plant (Quart. Journ. Micr. Sci. vol. xxi.).

and tears asunder the seed-coats at one end, and the cotyledons are thus easily withdrawn."

May not the narrowness of the cotyledons in *Eschscholtzia* and their deep fission be due to a similar cause? The seed is slightly pyriform, and the radicle emerges from the narrower end. It bursts through the soil in an arch, and instead of leaving the seed behind as usual, the cotyledons carry it up with them. Then the two arms of the cotyledons separate, thus widening the orifice and drawing themselves out.

This suggestion seems to be confirmed by the evidence of *Schizopetalon* (figs. 120–123), one of the other few cases where the

Fig. 120.

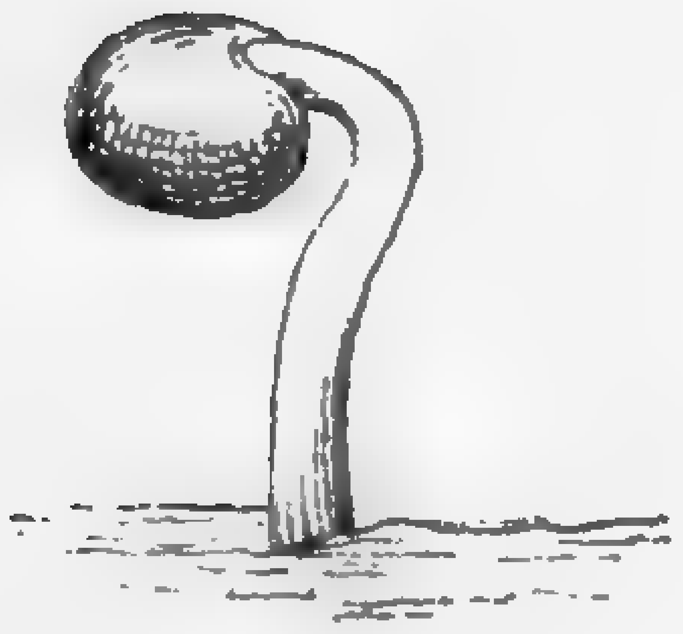


Fig. 121.

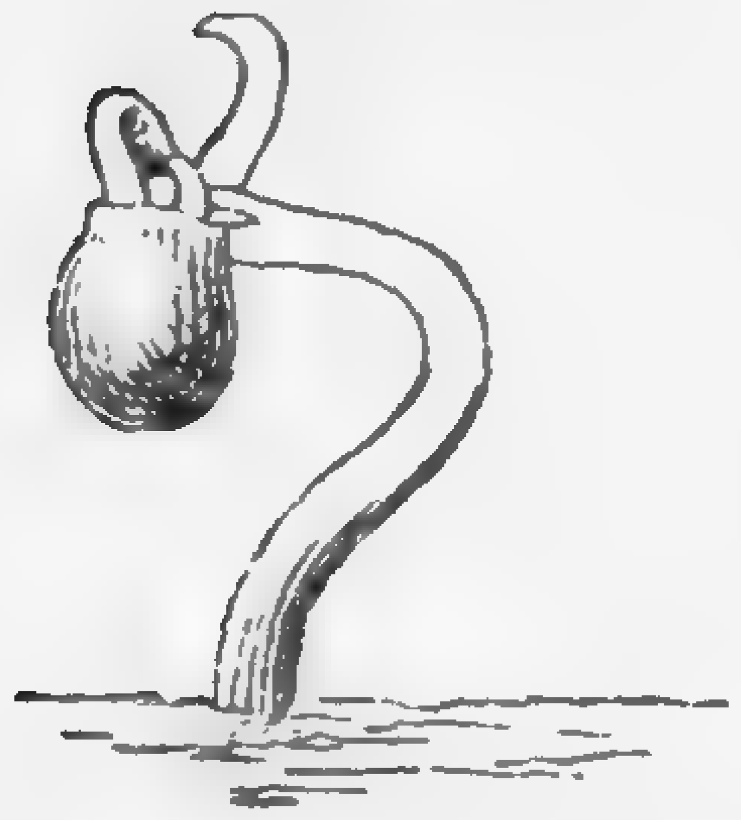


Fig. 122.

Fig. 123.

Figs. 120–123. Stages in the growth of seedling of *Schizopetalon Walkeri*, × 2½.

cotyledons are bifid. Here, also, the radicle emerges through a comparatively small orifice, and the seed, from which the cotyledons seem to have some difficulty in freeing themselves, is carried up by the embryo, while eventually the lobes of the cotyledons draw themselves out one by one. In *Opuntia basilaris*, again, which differs from *O. Labourtiana* in having narrow cotyledons, the seed is similarly carried up, and the cotyledons free them-

selves by divergence. In this species, also, it is interesting that one or both cotyledons are often bifid. Is it possible that the multiplicity of the cotyledons in Conifers (fig. 124) can be due to the same cause?

In *Ephedra* there is a special membrane, which remains attached to the root, and thus prevents the testa from being carried up on the tips of the cotyledons.

The common Cress (*Lepidium sativum*) (fig. 4), to which I have already referred, is a very interesting case, for while in the other species, at any rate in the other English species, of the genus the cotyledons are entire, in *Lepidium sativum*, on the contrary, each possesses two long, narrow lateral lobes.

Fig. 125 represents a section through the seed of *L. graminifolium*, which may be taken as representing the ordinary arrangement in the genus. The seeds, conforming to the shape of the

Fig. 124.

Fig. 125.

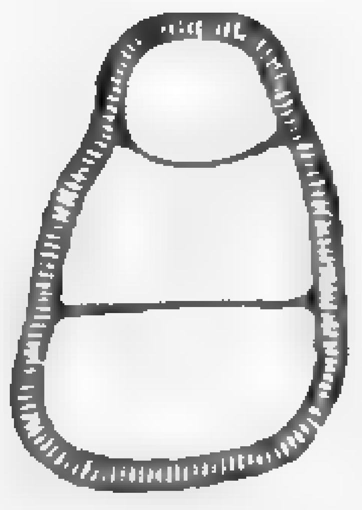


Fig. 126.

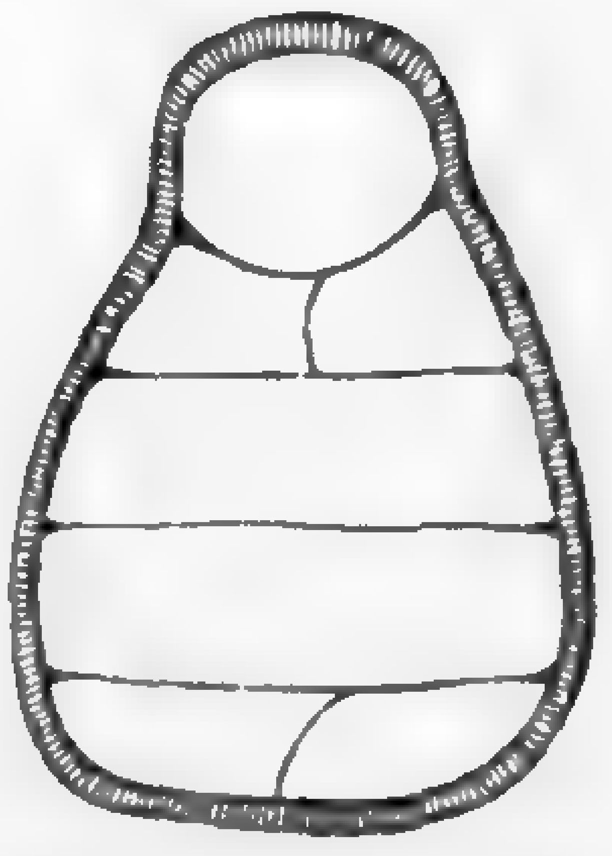


Fig. 124. Seedling of *Pinus rigida*, × 2.
Fig. 125. Section of seed of *Lepidium graminifolium*, × 15.
Fig. 126. Section of seed of *L. sativum*, × 15.

capsule, are somewhat triangular, with the radicle in the narrow end. The embryo occupies the whole of the seed, there being no perisperm. In *L. sativum* (fig. 126) the seed is of the same form, but nearly twice as large, and if, therefore, the cotyledons were to occupy the whole additional space, they would become extremely thick. In perispermic seeds this would present no difficulty, as the additional space would be simply filled by perisperm. In *Lepidium*, however, this device cannot be resorted to; the two lobes, however, just fill up the vacancy.

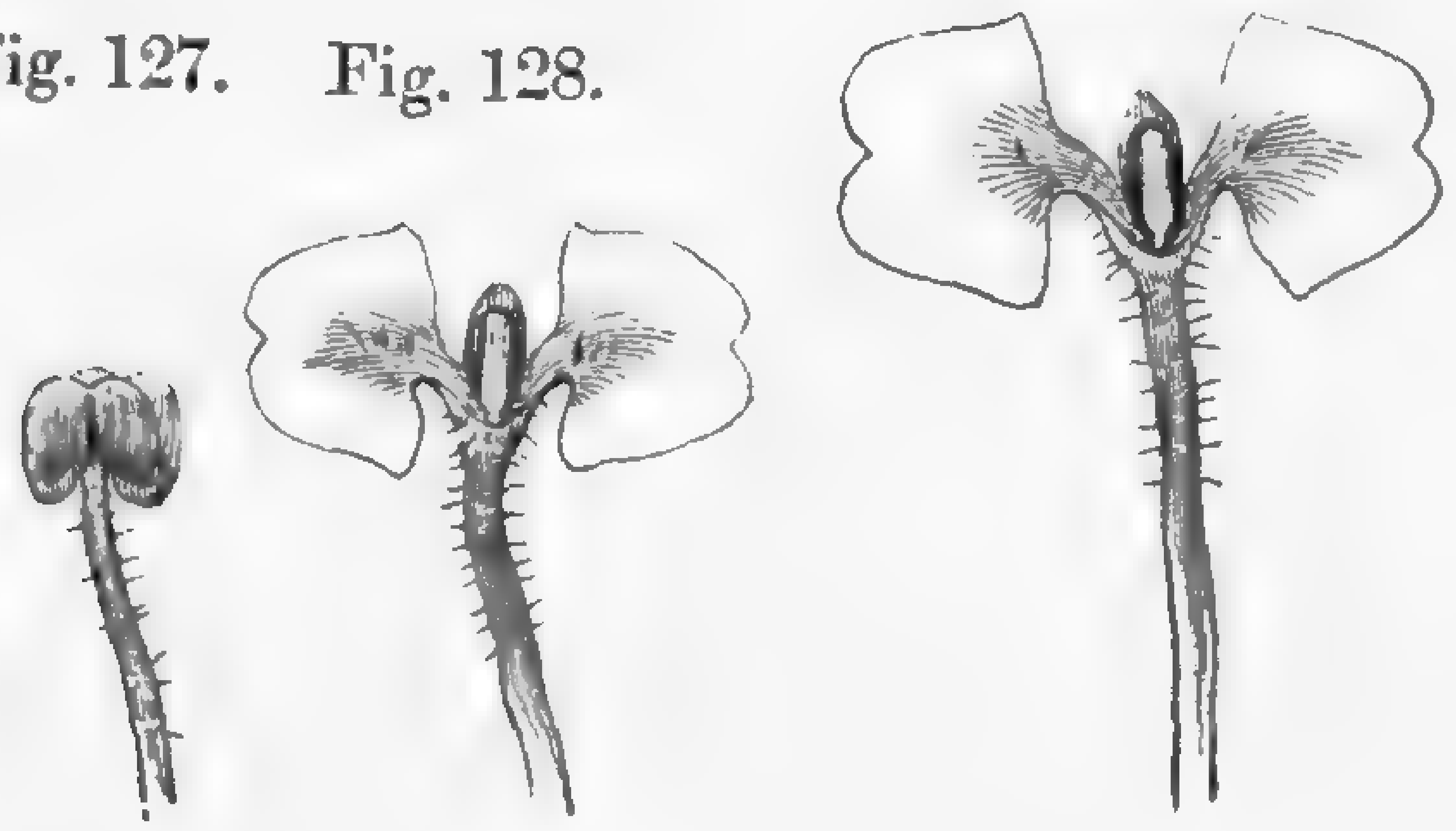
Auricled Cotyledons.

Some cotyledons are markedly auricled. As illustrations I give *Poterium* (fig. 42) and *Hakea* (fig. 21). This form is, I am disposed to suggest, a provision to fill up vacant space in the seed. In the seed of *Hippophaë* (fig. 55) the form of the cotyledon leaves at each side of the base of the cotyledon two spaces (*d*), which are occupied by perisperm. In *Cuphea* (fig. 100), *Ruellia* (fig. 57), and *Poterium* (fig. 99), on the other hand, there is no perisperm, and it is consequently an advantage that the cotyledon should develop auricles in order to fill up the space.

If this is the explanation of the auricles, we should expect to find them developed principally in families where the perisperm is deficient. Now in the species I have examined, auricled cotyledons occur in 35 genera, belonging to 22 families, of which 13 have no perisperm, while in 6 of the 9 others it is reduced almost to a film.

The argument in the case of *Cuphea* is further strengthened by the peculiar conformation of the radicle (fig. 100), which is three-lobed, the reason being, I would suggest, that the radicle cooperates with the cotyledons in the endeavour to fill up the vacant spaces.

Fig. 127. Fig. 128. Fig. 129.



Three stages in the growth of the seedling of *Cuphea silenoides*.

In support of this view I also would observe that the auricles seem to be of little use to the young plant. For instance, the embryo of *Cuphea*, while in the seed (fig. 100), has very large auricles, which in the seedling (figs. 127–129) soon disappear. In *Ruellia*, again (conf. figs. 57 and 16), we have a similar case.

Size of Seeds.

As regards the size of seeds, if we could imagine a state of

things in which every seed grew and attained maturity, then to keep up the number of any given species existing at any time, it would be sufficient if each plant produced but one or two seeds during its whole life. There is, however, an enormous destruction of seeds. The great majority are eaten by animals, or fail to secure a suitable site for germination; of those which do germinate, again, many are crowded out by their fellows; and Darwin observed that out of 357 seedlings which came up in a space of 3 feet by 2, no less than 295 were destroyed by slugs and insects. The greater the chance against any given seed reaching a suitable locality and attaining maturity, the larger number of seeds must the plant produce in order to maintain its numbers, and, as a general rule, the smaller will the individual seeds be. On the contrary, the greater the chance that each seed enjoys of arriving at maturity, the smaller the number of seeds that is necessary, and in such cases it is an advantage that the seeds should be large.

Hence parasitic plants generally produce a large number of very small seeds, though there are exceptions due to other considerations, as, for instance, in the Mistletoe (I believe, indeed, all the Loranthaceæ), where the seeds are carried by birds.

An interesting illustration is afforded by certain species which produce two kinds of pods, as, for instance, *Cardamine chenopodifolia* of Brazil. Besides ordinary pods, which resemble those of any other Cardamine, and contain several seeds, this plant produces a second sort of pod underground. Now in the ordinary pods the number of seeds increases, of course, the chance that some one will find a suitable place. On the other hand, the subterranean pods are sown, as it were, by the plant itself. In this case, if there were a number of seeds they would only get in one another's way, and hence, perhaps, the fact that the subterranean pods only produce one or two seeds. In most species the seeds vary somewhat in size; but in such cases it would not be conclusive to contrast the produce of large seeds with that of smaller ones, because it might fairly be said that the former were better nourished, and inherently, perhaps, more vigorous. In *Cardamine chenopodifolia* of Brazil, however, the seeds from the underground pods are larger than the others, and Grisebach found that they produced more vigorous seedlings *.

There are, on the contrary, other considerations which may

* "Der Dimorphismus der Fortpfl. v. *Cardamine chenopodifolia*," Göttinger Nachrichtungen, 1878, p. 334.

make it an advantage that the number of seeds produced by a flower should be reduced, as, for instance, in the case of the Compositæ, where the agglomeration of a number of flowers into a single head, as in the Daisy, and their consequent diminution in size, renders it an advantage that each floret should produce but one seed.

The species with large seeds may, as already mentioned, be divided into two groups—first, those in which the embryo is surrounded by perisperm, and, secondly, those in which it occupies the whole seed.

In the former the arrangement of the embryo presents no special difficulties, as the perisperm simply fills up all vacant spaces. In the latter, on the contrary, Nature has to exercise much ingenuity, and adopts various devices to fill up the whole space.

One plan is to arrange the cotyledons face to face, and then roll them up in a ball. This is adopted, amongst other cases, in the Sycamore (fig. 52), and hence the long strap-like form of the cotyledons.

Another is to arrange the cotyledons face to face, and then double them up, as in the Cabbage, Mustard, Radish (figs. 75–77), &c.

In a third the cotyledons are convolute edgeways, as in *Calycanthus*.

In *Lepidium sativum* the cotyledons are trifid (figs. 4 and 126); in *Cordia* they are thrown into plaits (fig. 87). In others we have still more complex folds, as in the Beech.

In such cases as the Lupine the cotyledons become so fleshy and thickened, that they almost lose the appearance of leaves; in this instance they are set free by the splitting of the testa. When, however, the testa does not readily split, and where in large seeds there is no perisperm, the difficulty of unfolding the cotyledons and extricating them from the seed becomes greater, and we arrive at cases where Nature seems to have abandoned the attempt, and, as in the Oak and Horse Chestnut, the cotyledons never quit the seed. Thus, among the Juglandeæ, *Pterocarya* has leaf-like cotyledons, while those of the Walnut never quit the shell. Every one, however, must have observed the elaborate folds into which the two cotyledons are thrown—folds which seem to have no significance or importance now, and which carry us back to a time when the Walnut, like the *Pterocarya*, had foliaceous cotyledons.

If these suggestions be correct, we should expect that species with non-emerging cotyledons would generally have large seeds and be aperispermic. This certainly appears to be the rule; among the species with reference to which I have notes, there are 37 genera in which the cotyledons are subterranean or remain in the seed. The seeds themselves are notably large, and all but three are aperispermic. Occasionally we meet with subterranean and foliaceous cotyledons in the same genus, as, for instance, in *Rhus*, *Rhamnus*, *Mercurialis* *, *Phaseolus*, &c.

Phaseolus vulgaris presents us with an intermediate stage, the cotyledons being aerial and green, but fleshy and by no means true leaves. In *Melittis melissophyllum*, again, according to Irmisch †, the fleshy cotyledons generally remain in the seed, and are held together by the testa; but they sometimes burst the shell, and stand out from one another. Like true subterranean cotyledons, they have no stomata.

When the cotyledons are large, thick, and fleshy they often contain sufficient nourishment to render the plants for some time independent of any fresh supply. In such cases the seedlings sometimes push up for awhile without any fully-developed leaves, the first few being reduced to very small size or almost obsolete, as in *Rhus* (fig. 44), *Sapindus* (fig. 43), *Tropæolum*, &c.

Size of Embryo.

As already mentioned, there are many cases, in fact many whole orders, in which the ripe seed is entirely occupied by the embryo; in other cases, again, as in *Delphinium* (fig. 130), the embryo is very small, and examples of every intermediate stage might be given.

Where it is an advantage to the plant that germination should be rapid, this of course can be more readily secured if the embryo is large. In fact, we find that species with large embryos, such, for instance as Cabbage, Pea, &c., germinate much more rapidly than those, such as Umbellifers, Ranunculaceæ, &c., in which the embryos are small.

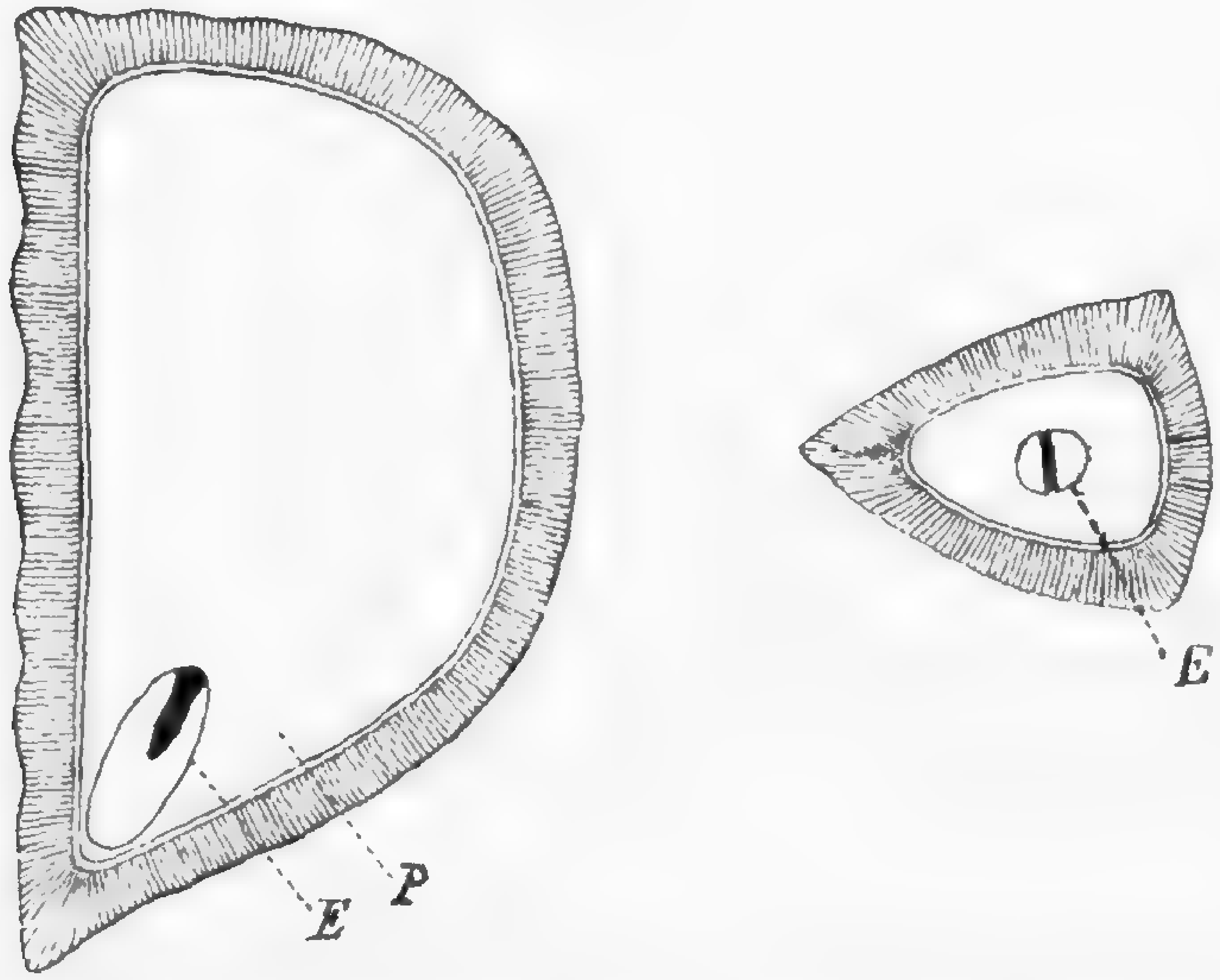
On the other hand, in other cases, time is less important, and

* Winkler, 'Flora,' 1880, p. 339.

† "Zur Naturgeschichte von *Melittis melissophyllum*," Bot. Zeit. 1858, p. 233.

here other considerations come into play. The protection of the embryo is mainly effected by the outer coverings; but the peri-

Fig. 130.



Long and transverse sections of seed of *Delphinium Staphisagria*, × 12.

sperm itself contributes also *, and hence a small embryo is less liable to injury.

Size of Cotyledons.

It is hardly necessary to say that the size of the plant does not determine that of the cotyledons. Winkler has pointed out that the largest of our Nettles has the smallest cotyledons †. It is, on the other hand, natural that large seeds, as a general rule, produce large cotyledons. This is, however, by no means a complete explanation. There are many cases in which the cotyledons grow considerably after quitting the seed. In the wonderful genus *Welwitschia* it was, at one time, supposed that the two great leaves were persistent cotyledons. This view is now abandoned. In many of the Monocotyledons, however, the cotyledons acquire a considerable length. I have already had occasion to allude to cases among the Dicotyledons in which the cotyledon continues to grow for some time after quitting the seed.

* See Marloth, "Ueber Mech. Schutzmittel der Samen gegen schädliche Einflüsse von Aussen," Engler's Bot. Jahrb. 1883.

† "Ueber die Keimblätter der deutschen Dicotylen," Verh. bot. Ver. Brandenburg, 1874, p. 11.

Streptocarpus Rexii affords, perhaps, the most remarkable case. The cotyledons are at first small, rotund, and shortly petiolate. Soon, however, one of them begins to grow, and becomes an at first ovate, then oblong, and finally pandariform, obtuse, entire, persistent leaf, attaining a length of more than 18 inches. The other cotyledon retains the original form, and soon drops off. In some specimens, however, both cotyledons retain their original form, and it is the first true leaf which develops.

In the cultivated form of the Mango, the cotyledons are divided into more or less irregular lobes; and in a specimen kindly given me by Mr. Ridley, one of the lobes developed into an independent plant.

In *Œnothera* and some allied species, as already mentioned, the full-grown cotyledons have a terminal lobe, which is, in reality, the original cotyledon, while the larger, basal part is due to subsequent growth. I hope to describe these more fully in a future memoir.

Concluding Remarks.

The conditions under which the seedlings are grown naturally exercise some influence on the form of the leaves. For instance, in *Mimulus luteus*, if the seedlings have sufficient room the first leaves are shortly stalked and deltoid, while the primary nodes are but little developed; on the contrary, if they are more crowded, the internodes and petioles are longer and the leaves are oval.

In the Primrose we find an arrangement which almost seems as if it were intended to give the seedling some power of locomotion. The caulicle is sometimes horizontal, and throws out strong adventitious roots, the upper part, however, becoming vertical as usual.

As a general rule, the first buds produced by the seedlings are in the axil of the leaves, or more rarely of the cotyledons. In some species of *Linaria*, however, the caulicle itself throws out one or more buds which develop into branches. The advantage of this may be that, if the main shoot is cropped or broken even down to the root, the plant is capable of throwing up another stalk.

We thus find an almost inexhaustible series of beautiful adaptations to purpose. On the other hand, there are not wanting cases in which it would seem that the adaptation is not complete, or that

a certain change, which has been of superior importance, has involved a minor evil.

The Oak, Beech, Nut, &c. afford us a very interesting series of species. Fig. 132 represents a diagram of a nut with the parts somewhat separated from one another, so as to show the relations more clearly. The micropyle (*m*) is at the apex of the seed. The ovule, however, is not straight and orthotropous, which would be, or at any rate seem to be, the simplest arrangement. Quite the contrary, we find a long placental axis (*pl*) which extends to the apex of the nut, and from which starts a raphe (*r*), which returns about halfway back again to the place where the true attachment or chalaza (*ch*) is situated. I have in vain endeavoured to discover or imagine any circumstances which would render this complex arrangement specially adapted to present conditions. It would seem as if it would be simpler and give Nature less trouble if the ovule sat directly with its base on the stalk, thus doing away with both the placental axis (*pl*) and the raphe (*r*).

This view is strengthened by the fact that such an arrangement has been in fact nearly attained by the Oak. The ovule in that genus is theoretically anatropous, but the placental axis and the raphe are both greatly shortened (fig. 131), so that the distance which the nourishment has to traverse is much less, though the actual place of attachment remains the same. The Oak in fact seems to have appreciated the difficulties of the situation, and to have in great measure neutralized them. Is it fanciful to imagine that some ages hence the Oak may be practically orthotropous?

But why should these species be anatropous if it is an advantage to be orthotropous? On this question some light is thrown by the fact that while one seed only comes to maturity, the ovary contains originally several cells each with one or two ovules, though none of the others come to anything. They can, however, easily be seen, either at the apex of the seed, as in the Nut (fig. 132, *o*), Beech (*Fagus*), &c., or, as in the Oak (fig. 131, *o*), near the base. Their presence appears to indicate that these species are descended from ancestors the fruit of which was composed of several cells, each with more than one seed—a state of things therefore very unlike the present, and when the anatropous condition would be an advantage. If this view be correct, the structure of the fruit in the Nut, Beech, &c. becomes peculiarly

interesting, because it represents a case in which the present arrangements are not those in all respects most convenient to the plant, and render it probable that the same explanation may apply to other cases of difficulty.

Fig. 131.

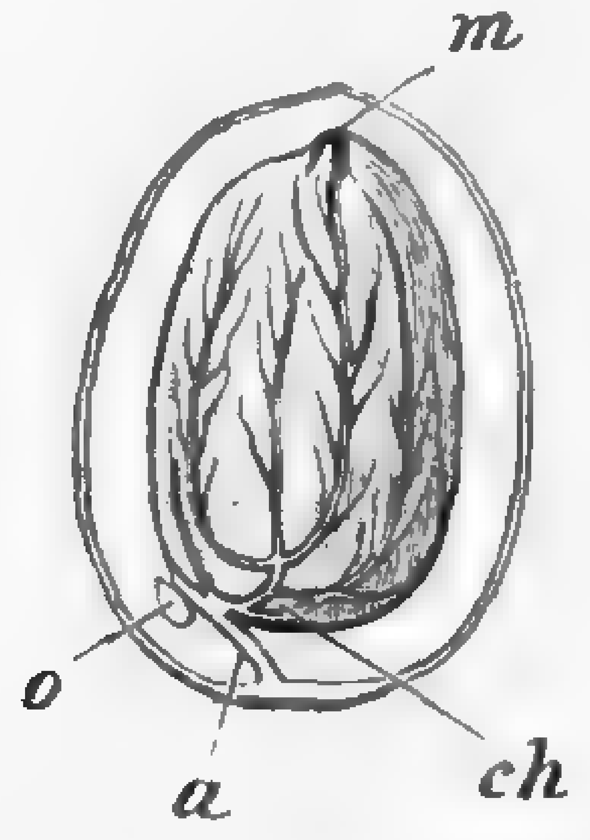


Fig 132.

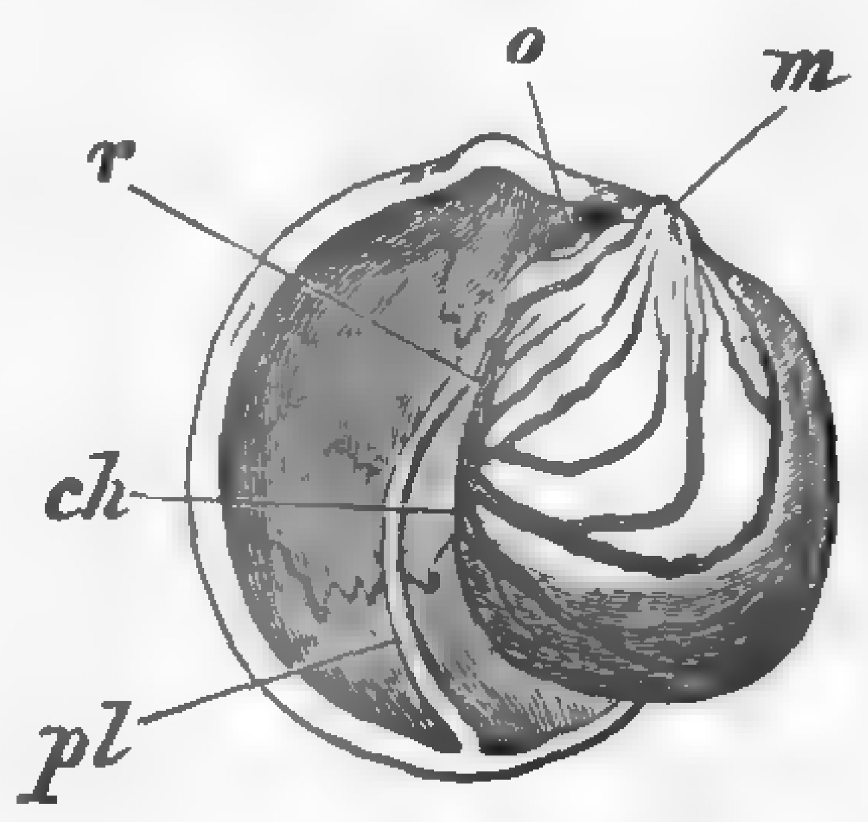


Fig. 131. Seed of Oak (*Quercus pedunculata*). Nat. size. *o*, abortive ovule.
Fig. 132. Seed of Nut (*Corylus avellana*). Nat. size. *o*, abortive ovule.

We meet indeed with a great many cases in which a larger or smaller number of the ovules, often all but one, fail to become developed. In some of them we may perhaps see a provision to increase the chances of fertilization. There are others, however, in which this explanation will not hold good. In *Ptelea*, for instance, the ovary consists of 2–3 cells, each containing 2 ovules, one inserted rather above the other, and the inferior ovule constantly fails to develop. In this and other similar cases we can hardly doubt that the existence of this second, and now functionless, ovule carries us back to a time when the ancestors of our present *Ptelea* habitually produced two seeds.

In *Paliurus* the fruit normally contains three, but sometimes only two loculi, each with a single seed. Again, in *Myagrum* the ovary is spuriously 3-celled, but the two outer cells produce no seed. In *Hæmanthus* there are three cells, each containing a seed, only one of which, however, comes to maturity. In *Convallaria* there are three cells, each with two ovules, but only one of the six is generally developed. In *Phillyrea* there are two ovules, only one of which is developed. In *Canarium* there are two, only one of which is developed; and we meet with similar cases in *Gyrinopsis*, Jasmine, *Æsculus*, *Cordia*, and many others.

From the point of view as to the origin of these differences the variations in seedlings offer great interest. For example, out of 135 seedlings of *Lepidium sativum* (which, as already mentioned, differs from the rest of the genus in having tripartite

cotyledons), no less than 25, or as much as $18\frac{1}{2}$ per cent., differed from the type, and had this character more or less imperfectly developed. Under cultivation the seedlings of *Primula sinensis* often have one of the cotyledons deeply bifid; in one lot of seedlings this was the case with, for instance, over 20 per cent. of the plants.

In *Poterium Sanguisorba* the calyx-tube generally contains one, but sometimes two or even three achenes. In *Ranunculus*, occasionally, the petioles of the cotyledons are connate.

In *Œnothera* the cotyledons are either straight, or with one or both involute. Irmisch states that the cotyledons of *Clematis recta*, which are usually aerial, sometimes remain below ground; while the reverse is the case in *Melittis*, and, according to Winkler, in *Dentaria* and *Mercurialis*, for the cotyledons, which are generally fleshy and subterranean, sometimes rise above ground and form small green leaves.

Many species occasionally have one or both cotyledons divided*.

In *Rheum* the cotyledons are generally parallel, but in some cases one of them is placed more or less obliquely with reference to the other.

In *Fagopyrum* the position and arrangement of the cotyledons in the seed vary greatly. The cotyledons are turned about after striking into an angle of the seed, and then, following the testa, assume very various positions. In *Carum carvi* the cotyledons sometimes have their backs to the axis of the fruit, and sometimes their edges, while at others they are oblique.

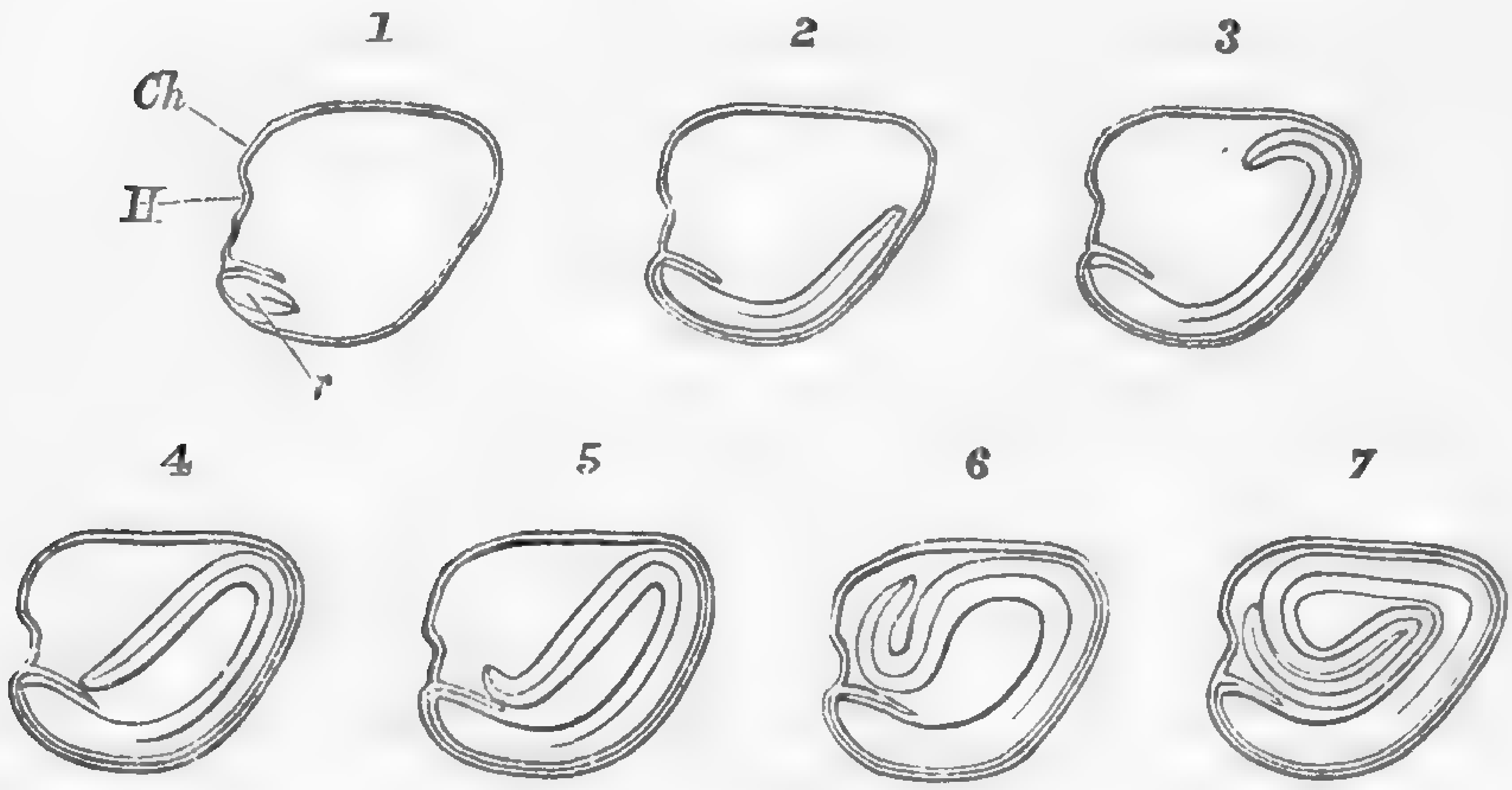
In *Cheiranthus pygmæus* the cotyledons are said to be sometimes accumbent, sometimes incumbent, and straight or convolute, even in the same pod.

It would be easy to multiply such cases, but I will only mention one more, in which I will venture to suggest a reason for the variation. In *Acer* (fig. 133, 1), the embryo originates in a short tubular prolongation of the micropyle, and is at first straight with an extremely short turbinate radicle, and ovate obtuse, closely adpressed cotyledons. As growth continues the embryo extends itself along the lower side of the seed, and curves with it, becoming gradually lanceolate, or oblong lanceolate (fig. 133, 2). When the cotyledons have reached the upper, narrow end of the seed, the curvature of the wall turns

* See Goebel, Grundzüge Syst. Spec. Pflanzen Morphologie, p. 505.

them down again on themselves (fig. 133, 3). This growth is continued until the tips reach the radicle again, and the ultimate arrangement of the embryo differs according to whether they then curve inwards or outwards. This, again, seems to depend on the exact direction of the growth of the cotyledons. If they strike (fig. 133, 5) against the process which encloses the radicle,

Fig. 133.



Acer Pseudo-Platanus.

Sections of seed in seven successive stages, showing growth of embryo. × 3.

then their general direction naturally carries them outwards, until the wall of the seed again turns them upwards, so that they become plicate; if, on the contrary, the tips of the cotyledons pass just within the micropylar process and touch the radicle, then they are compelled to grow in the opposite direction, and they become spirally coiled. In the specimens examined the latter arrangement was exceptional.

Forms of the First Leaves.

Time does not permit me to enter into any particulars with reference to the first leaves and the transition between them and those of the final form. I will only observe that the first leaves are generally simple, or at any rate simpler than those which follow.

In species with trifoliate leaves, the first leaf is generally simple, as in the Clovers. When the mature leaves are pinnate, the first ones are generally trifoliate; and when the final leaves are bipinnate, the first ones are generally pinnate. I have already observed that species with lobed or palmate leaves often commence with one or more which are entire and heart-shaped.

In most cases, therefore, the first leaves are simpler than those which follow. In species from very dry localities, however, the reverse is often the case. For instance, in *Lasiopetalum ferrugineum* (fig. 134), from Adelaide, the first few leaves are spatulate and more or less lobed, the final ones linear. Again, in *Dodonæa viscosa*, also from Adelaide, the first leaves are lobed, the subsequent ones simple.

Fig. 134.

Seedling of *Lasiopetalum ferrugineum*. Half nat. size.

Relation of the Seedling to the Seed.

To return for one moment to the case of seedlings. The question of course arises whether the embryo conforms to the seed, or whether the shape of the seed is determined with reference to the form of the cotyledons. The seeds, however, evidently depend on the habits, conditions, &c. of the parent plant. I have elsewhere dealt with the structure of the seed, and must content myself here with the simple statement that we have no reason to suppose that it is influenced by the form of the embryo. On the other hand, it seems equally clear that the form of the embryo, and especially of the cotyledons, is essentially influenced by that of the seed.

The Tea (*Thea*), for instance, presents us with a very interesting case, in which the cotyledons vary greatly in shape, following that of the seed, and depending on the number of ovules which develop; they are contained in a wooden capsule, and are variously compressed. In *Citrus* also the cotyledons are unequal

and irregular, several embryos being contained in each seed, and sometimes squeezed together in the utmost confusion.

In several other cases, among those which have been already referred to, we can hardly doubt, I think, that the form of the cotyledon has been affected by the seed and not *vice versâ*.

Let me in conclusion take one other illustration. The cotyledons of the Sycamore (fig. 9) are long, narrow, and strap-like; those of the Beech (fig. 13) are short, very broad, and fan-like. Both species are aperispermic, the embryo occupying the whole interior of the seed.

Now in the Sycamore the seed is more or less an oblate spheroid, and the long ribbon-like cotyledons, being rolled up into a ball, fit it closely, the inner cotyledon being often somewhat shorter than the other. On the other hand, the nuts of the Beech are more or less triangular: an arrangement like that of the Sycamore would therefore be utterly unsuitable, as it would necessarily leave great gaps. The cotyledons, however, are folded up like a fan, but with more complication, and in such a manner that they fit beautifully into the triangular nut.

Can we, however, carry the argument one stage further? Why should the seed of the Sycamore be globular, and that of the Beech triangular? Is it clear that the cotyledons are constituted so as to suit the seed? May it not be that it is the seed which is adapted to the cotyledons? In answer to this we must examine the fruit, and we shall find that in both cases the cavity of the fruit is approximately spherical. That of the Sycamore, however, is comparatively small, say $\frac{1}{5}$ inch in diameter, and contains one seed, which exactly conforms to the cavity in which it lies. In the Beech, on the contrary, the involucre is at least twice the diameter, and contains from two to four fruits, which consequently, in order to occupy the space, are compelled (to give a familiar illustration, like the segments of an orange) to take a more or less triangular form.

Thus, then, in these cases, starting with the form of the fruit, we see that it governs that of the seed, and that of the seed again determines that of the cotyledons. But though the cotyledons often follow the form of the seed, this is not invariably the case: other factors must also be taken into consideration; but when this is done, we can, I venture to think, throw much light on the varied forms which seedlings assume.

On the Floral Conformation of the Genus *Cypripedium*.

By MAXWELL T. MASTERS, M.D., F.R.S., F.L.S., &c.

[Read 18th November, 1886.]

(PLATE XX. and ten Woodcuts.)

GENERAL CONFORMATION OF ORCHID FLOWERS.

The usual conformation of an Orchid flower *, the relative disposition of its parts, and the general course of their development are so well known that for the present purpose it is only necessary to advert to the relatively excessive development of the median petal or lip, and to allude to the construction of the "column" from three, or more frequently from six (potential) stamens arranged in two rows, an outer and an inner, and concrescent with three styles.

According to the plan followed by Darwin †, and now generally adopted, the outer stamens are, for convenience' sake, denoted as A_1, A_2, A_3, the three inner ones being marked by corresponding smaller letters a_1, a_2, a_3. Similarly, the carpels of the gynæcium may be marked G_1, G_2, G_3. S may stand for the sepals, P for the petals, P_3 or L for the median petal or lip, and × for the staminode ‡. In the great majority of Orchids the outer median stamen A_1, placed opposite the median petal, is the only one that attains its full development. Any or all of the other five may, under exceptional circumstances, be present, either in a perfect anther-bearing state, or more commonly in the guise of petals. Thus, in *Odontoglossum crispum* I have met with all six stamens fertile and free §. *Arundina pentandra* is described by Reichenbach as having five stamens; and Fritz Müller mentions

* See Eichler, 'Blüthen Diagramme' (1875), i. p. 179 *et seq.*; Gérard, "Sur l'homologie et le diagramme des Orchidées," Ann. Sc. Nat. Bot. 6e sér. t. viii. p. 213, 1878; Van Tieghem, 'Traité de Botanique' (1884), p. 1387, and the same author, 'Sur l'Anatomie comparée de la Fleur' (1871), p. 140; Pfitzer's 'Morphologische Studien über die Orchideenblüthe' (1886) has been issued since this paper was written.

† 'Fertilization of Orchids,' ed. 2 (1877), p. 236.

‡ It must be borne in mind that throughout this paper the flower is supposed to be in the adult stage subsequent to any torsion, and that the numbers A_1 &c. do not apply to the order or period of development of the several parts.

§ Masters, 'Pflanzen Teratologie,' ed. Dammer (1886), p. 439, figs. 213, 214. In this edition numerous instances are cited of polyandry in Orchids in addition to those mentioned in the original edition (1869), p. 382. See also Masters, "Orchids single and double," in 'Gardeners' Chronicle' (1885), May 5, p. 597.

an *Epidendrum* one form of which is constantly triandrous (Bot. Zeit. 1872, no. 10, p. 152). By some observers it is considered that traces of the undeveloped stamens of the outer, and perhaps also of the inner, row are to be seen in the shape of lateral outgrowths from the column, or, as in *Cypripedium*, in the form of lateral lobes of the staminode ; but this opinion, as also the view that one or more stamens are incorporated with the lip, I believe, for reasons hereafter given, to be erroneous *.

In *Zygostates cornuta* (according to Pfitzer, *l. c.* p. 88), in addition to the ordinary median stamen A_1, there are present A_2, A_3, and a_3, in the form of sterile filaments. Lindley, however ('Vegetable Kingdom,' ed. 3 (1853), p. 183[b]), referred the staminodes of this plant entirely to the inner series. In *Thelychiton*, Endlicher, Iconog. t. 29, there is a central stigma surrounded by a lobed cup bearing on one of its lobes an anther. Crüger † describes and figures an *Isochilus* in which the flower is normally triandrous, but which often bears five anthers with a filament proceeding from the front of the column just beneath the stigmatic cavity. Van Tieghem ‡, relying exclusively on the distribution of the vascular bundles, gives an account of the arrangement of the parts, in some measure at variance with the generally received opinions, but he concludes thus :—" l'androcée des Orchidées est donc constituée idéalement par six étamines superposées, en deux verticilles ternaires aux divisions du perianthe."

Bract.
S_1
P_1 P_2
A_1
a_1 a_2
G_1
G_2 G_3
a_3
A_2 A_3
P_3
S_2 S_3
Axis.

Diagrammatic illustration of the arrangements of the parts of an Orchid flower.

The ternary nature of the gynæcium is generally admitted, though it is marked by abortion and concrescence. In a flower of *Pleione birmannica* recently examined all three stigmas were present. The distribution of the nerves in the column showed that the large wings of the column, which might readily be mistaken for lateral stamens A_2, A_3, were really subdivisions of A_1.

The appended scheme, showing the relative position of the

* See Robert Brown, "Observations on Apostasia," in Wallich, Plantæ Asiat. Rarior. i. p. 74, and Miscellaneous Botanical Works, ed. Bennett (1866), i. 499.

† Journ. Linn. Soc., Bot. viii. p. 135.

‡ 'Anatomie Comparée de la Fleur,' p. 142.

parts in the generality of Orchids, may be useful for comparison. Letters in italics indicate parts that are generally absent, but which are potentially, and sometimes actually, present.

Conformation of Cypripedium.

In an ordinary *Cypripedium* flower, as seen in the adult condition, there are three sepals, the median one free, the two lateral ones not only concrescent, so as to form in appearance a single sepal, but removed from their typical lateral position into a median one opposite to the median sepal. The result is that the flower appears to have a two-parted calyx, the significance of which will become apparent when the details to be hereafter given are considered. The corolla, or inner row of the perianth, consists of two lateral petals, and of one median labellum or lip, usually bag-shaped and differing greatly in appearance from the lateral petals.

The andrœcium is composed of one median stamen dilated into a broad shield-like staminode, and of two lateral fertile stamens within the preceding. The gynæcium consists of an inferior ovary, distinctly 3-celled in *Selenipedium*, but 1-celled with three parietal placentas in other *Cypripedia*. One of the three carpels is median, in the same line as the median staminode, the other two carpels being lateral and superposed to the lateral sepals. The styles are concrescent with the stamens into a column, the apparently solitary stigma being developed in the median line, superposed to the staminode.

Thus the largest sepal S_1, the largest petal P_3, the staminode ×, and the stigma G are all in the median plane of the flower. This arrangement may be expressed by the accompanying plan.

Bract.
S_1
P_1 P_2
×
a_1 a_2
G_1
G_2 G_3
a_3
A *A*
P_3
S_2 S_3
Axis.

Diagrammatic illustration of the arrangement of the parts of the flower in *Cypripedium*.

The points specially worthy of note are the lip, the andrœcium, and the gynæcium. In the development of the flower, acccording to Crüger*, irregularity first shows itself in the median petal which develops itself into the lip.

As to the andrœcium, the generally accepted view is that which R. Brown originally propounded (but which he subsequently modified). According to this view the large staminode is the

* Journ. Linn. Soc. Bot. vol. viii. p. 134, t. 9.

median barren stamen of the outer row, A_1. The two lateral fertile stamens, a_1, a_2, belong to the inner row. All the other stamens are absent. It is possible, especially in cases of Peloria (see *post.*), that the lateral stamens of the outer row, A_2, A_3, may be sometimes represented in the lateral lobes of the staminode, although, from the distribution of the vessels, I do not think this is usually the case. This staminode, moreover, is often more or less three-angled, three-lobed, or two-lobed with a central knob or short projecting filament. Link, as cited by Eichler *, was of opinion that the fertile anthers originated from the division of one median stamen, the staminode being looked on as an enormously developed connective. But although the staminode often shows signs of bi-partition, the whole weight of evidence, whether from morphology, teratology, or anatomy, is against Link's view. The teratological evidence will be alluded to later on, and that furnished by the anatomy of the column may be deferred till the nature of the style is considered.

The large stigma of *Cypripedium* occupies, as previously stated, a median position, and this position gives rise to some perplexity on account of its appearing to be a single organ.

Bract.

G

G G

Diagrammatic illustration of the position of the stigmas in *Cypripedium*, which, however, are concrescent, not isolated.

The readiest mode of explaining the existence of a single stigmatic lobe would evidently be to assume that the two lateral carpels, at least their stylar portions, were abortive. An examination of the arrangement of the vascular bundles of the peduncle and of the column supplies another and more correct explanation.

Distribution of the Vascular Bundles.

Tracing the nerves from the stalk of the flower upwards to the ovary, and thence into the column, the arrangement is seen to be the following:—In the peduncle there are six vascular bundles in one ring. Following these upwards, three are found to correspond to the dorsal sutures of the carpels and three to the ventral or placenta-bearing margins. Although at first in one ring, at the level of the emergence of the perianth-segments, they form two rings one within the other, and their arrangement may be diagrammatically represented as follows, N_1, N_2, N_3 occupying the same positions as those occupied by the sepals, outer

* 'Blüthen Diagramme,' p. 181.

stamens, and carpels, while n_1, n_2, n_3 are in a line with the three petals and with the three inner stamens.

In fact, the median nerve N_1, after leaving the ovarian wall, divides radially into two divisions, one of which passes into the median sepal S_1, where it soon breaks up laterally into numerous subdivisions, while the other passes into the staminode A×.

N_1
n_1 n_1
n_3
N_2 N_3

Diagrammatic illustration of the nerves at the base of the flower.

The nerves N_2, N_3 pass into the corresponding lateral sepals without dividing radially, so that the cords corresponding to the stamens A_2, A_3 are, in this case, entirely wanting. The intermediate nerves n_1, n_2 each divides radially, one division passing into a lateral petal, the other into a fertile stamen. The median nerve of this series, n_3, passes into the lip, P_3, where it speedily trifurcates by lateral subdivision, but does not divide radially; for, as the inner median stamen a_3 is not developed, there is no vascular cord required for it *. The three cords for the gynæcial row are numerically as complete above as they are below the perianth, the primary nerves N_1, N_2, N_3 supplying the three carpels G_1, G_2, G_3.

A difficulty, as before remarked, arises as to the large and apparently single stigmatic lobe which is placed in the median line. It might readily be assumed that the two lateral styles were in this case absent, while the median one, G_1, was alone present. But this inference does not accord with the position of the placentas, two of which are placed laterally and one in the median line superposed to the lip. The placentas of course alternate with the styles, the styles in fact being prolongations of the dorsal sutures, while the placentas correspond to the united margins of three carpels. An examination of the vascular bundles in the style above the emergence of the stamens shows the three bundles N_1, N_2, N_3 very distinctly alternating with the 3-lobed mass of conducting tissue continuous below with the placentas. Into the stigmatic lobe itself, which is a triangular cushion-shaped body with the apex of the triangle in the middle line, it has appeared to me that the median bundle, N_1, does not always enter, though it does so in some cases. The other two bundles, N_2, N_3, corresponding to G_2, G_3, however, are always

* Darwin's view that the nerves corresponding to A_2, A_3 are in any degree incorporated with the lip is, I believe, an error; the nerves figured by him at the side of the lip result merely from the lateral branching of the bundle n_3.

present. The mass of the stigmatic lobe is made up of large thick-walled polygonal cells, many with nuclei and nucleoli; through this mass of parenchyma the vascular cords pass, the tracheæ being nearest to the lower or anterior edge. The lower or anterior part of the stigmatic lobe consists of several layers of cells of a very different character from those constituting the bulk of the lobe. They are elongated or club-shaped, in several layers, disposed more or less horizontally, thin-walled and nucleated, and bounded on the lower surface by a layer of papular cells.

This layer of stigmatic tissue, though to outward appearance unbroken, is seen, on inspection of microscopic sections, to pass inward and to separate the lobe into two divisions, corresponding to G_2 and G_3. Perhaps in some species G_1 may be cut off in a similar way, but this has not been the case in any of the flowers examined by me. The stigmatic lobe, therefore, so far from being single, as it appears to be at first sight, is certainly two-fold and, perhaps, in some species three-fold, the two or the three styles at their uppermost ends being united in the median line like the two lateral sepals. The column of *Cypripedium*, therefore, is made up of three stamens and of three styles. Of the three stamens the upper median belongs to the outer row and is developed as the staminode; the other two lateral ones are fertile and belong to the inner row. Of the three ovaries and three styles all remain, but of the three stigmas the upper or median one becomes abortive, while the two lateral ones are joined into one compound lobe *.

Teratology of Cypripedium.

Adverting now to the teratological appearances presented by this genus and its allies, I propose to confine attention to those malformations which more directly elucidate the plan of Orchid-structure, and to omit reference to those numerous cases of pure distortion or perversion which have no direct morphological significance from the present point of view.

So regarded, these malformations may conveniently be grouped under the heads of defect, of excess, or of perversion of the natural

* The description above given of the course of the vascular bundles of the column &c. agrees in the main with that given by Van Tieghem, 'Anatomie Comparée de la Fleur,' p. 144, tab. xii. figs. 209–219, and with that propounded by Gérard, *l. c.* p. 236. Van Tieghem, however, says nothing about the arrangement of the cords in the stigmatic lobe, nor is it alluded to by any other author, so far as I am aware.

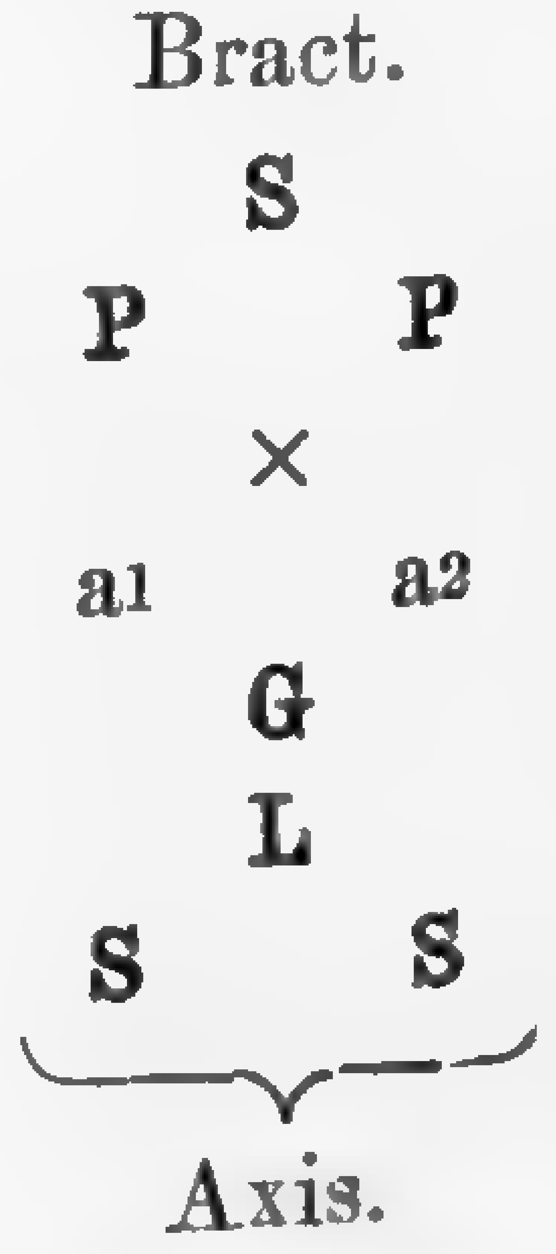
process of development. Some of these changes may thus be considered as progressive, others as retrogressive, and not infrequently as reversions to a prior and simpler condition *.

Oligomery.

I. *Reduction of Parts.*—A dimerous condition is one of the commonest deviations from the usual typical structure of Orchids in general. This arrangement may be thus represented, the two sepals being lateral, the solitary fertile stamen **A** and the stigma **G** being in the median line. This dimerous condition has some indirect analogy with the natural arrangement of parts in *Cypripedium*, where in the adult flower there are two sepals only (one of these, however, resulting from the concrescence of two), and in the presence in the median line of two much-modified parts, the lip and the staminode, the inner staminal whorl being represented by a pair of organs placed at right angles to these, and, as it were, decussating with them.

Diagrammatic illustration of dimerous Orchid.

In abnormal flowers of *Cypripedium Sedeni* the dimerous condition is associated with the presence of a single median fertile stamen in the position usually occupied by the staminode ×. In these cases the median sepal is generally absent, whilst the two lateral ones are either united or partially separated, and more or less dislocated or turned to the lower part of the flower. No lateral petals are formed, but a petal is placed above in the median line, in the position usually occupied by the median sepal, and in form and colour like one of the lateral petals. Opposite to this petal is placed a second one, lip-like in character, or sometimes flat †.



Diagrammatic illustration of arrangement of parts in *Cypripedium*.

* A very large number of specimens have been examined by myself during the last few years, and upon this examination these remarks are, for the most part, based. I avail myself, however, of this opportunity of thanking Mr. Hansen, of St. Alban's, for the privilege of inspecting a large number of drawings executed by him in the rich Orchid nursery of Mr. Sander.

† See Le Marchant Moore, in 'Journal of Botany' (1879), vol. xviii. p. 1; Masters, 'Vegetable Teratology,' p. 401; German edition, ed. Dammer (1886), p. 460; Magnus, Sitzungsbericht d. Gesellsch. Naturforsch. Freunde zu Berlin,

In a monandrous flower of *C. barbatum* sent me by Mr. Bull there were two lateral sepals turned downwards, an upper median

Fig. 1.

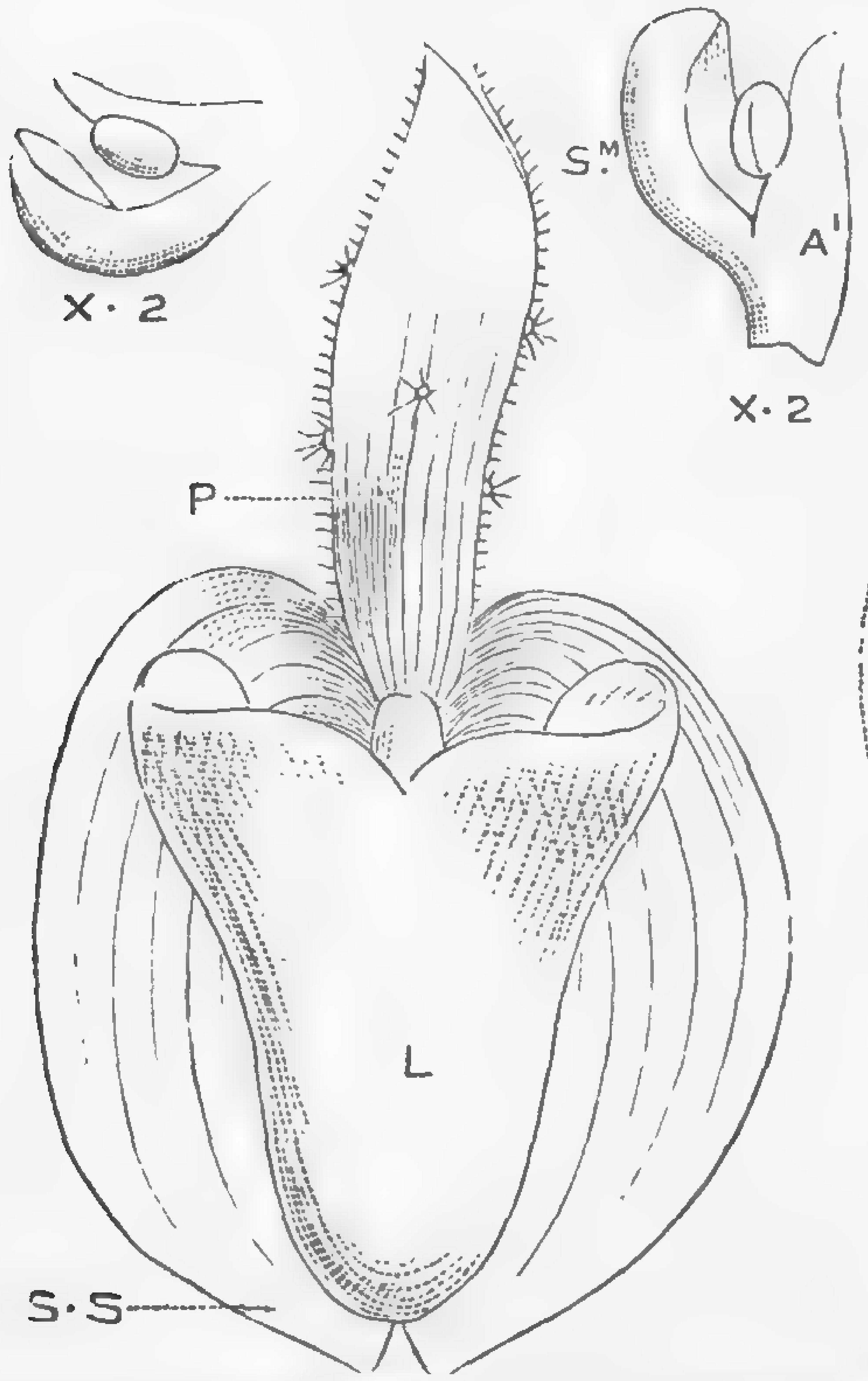


Fig. 2.

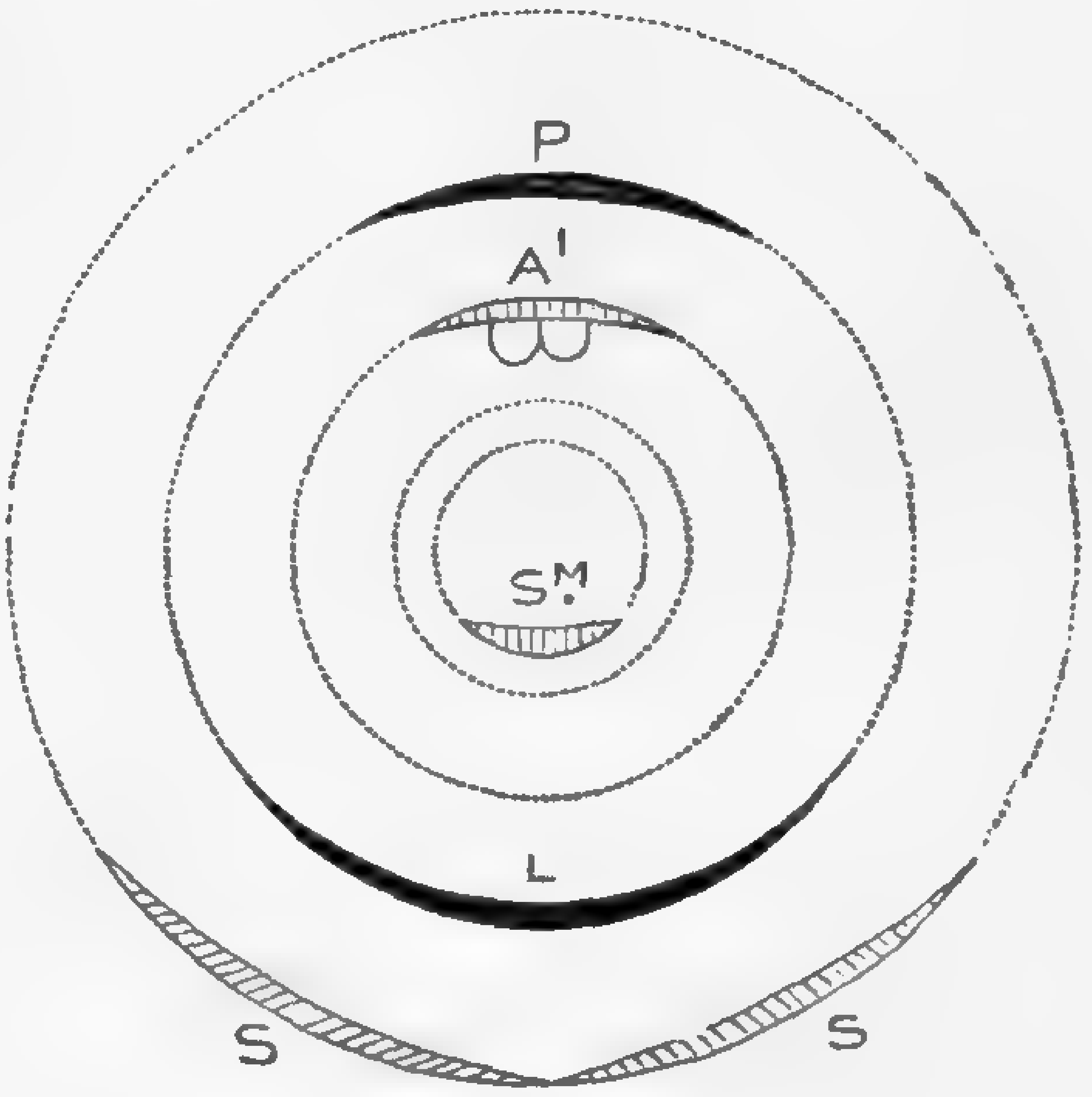


Fig. 1. Shows flower of *C. barbatum* described in the text. The column is shown as seen from the side.
Fig. 2. Diagram showing the arrangement of the parts in fig. 1.

petal P, and, opposite to it, a lip L. The column had one fertile median stamen, A_1, and in front of it one stigma, S^M, the other parts being absent. In Mr. Hansen's series of drawings I have seen illustrations of a similar malformation and dislocation in *C. Sedeni* ×, *C. barbatum*, *C. venustum*, and *C. Lawrenceanum*. The relative position of the parts in such flowers may be thus expressed :—

P
A_1
G
L
S S

Diagrammatic illustration of figs. 1 & 2.

The lateral sepals are usually conjoined and, as it were, dragged out of place and made to assume a median position more or less opposite the upper median petal ; but Mr. Hansen's drawings show various

(1878) June 18 and (1885) July 21 ; also Verhandl. d. Bot. Vereins d. Prov. Brandenburg (1882), xxiv. p. 111, and xxv. p. x, where other references to the literature of the subject are given. Dimerous flowers associated with the presence of one median fertile stamen, A_1, are frequently met with in this hybrid *Cypripedium*.

intermediate stages between perfect union and perfect dialysis of the sepals. Where the upper median sepal is present, it sometimes happens that the two lateral sepals are greatly reduced in size, so that various stages occur between the ordinary condition and one of dimery and decussation of parts. In all cases where the median stamen, A_1, is fertile, the large shield-like staminode, ×, which forms so characteristic a feature in ordinary *Cypripedium* flowers, is absent. In one flower of *C. Lawrenceanum* in which the perianth was dimerous, the andrœcium was trimerous, the stamens present being one of the outer row, A_1, and two of the inner row, a_1, a_2, thus :—

P
S A_1 S
G
a_1 a_2
L

Diagrammatic illustration of arrangement in a monstrous flower of *C. Lawrenceanum*.

It will be observed that one stigma alone was developed in the median line, but whether that one represented G_1 or a combination of G_2 and G_3, as under ordinary circumstances, I was not able to ascertain.

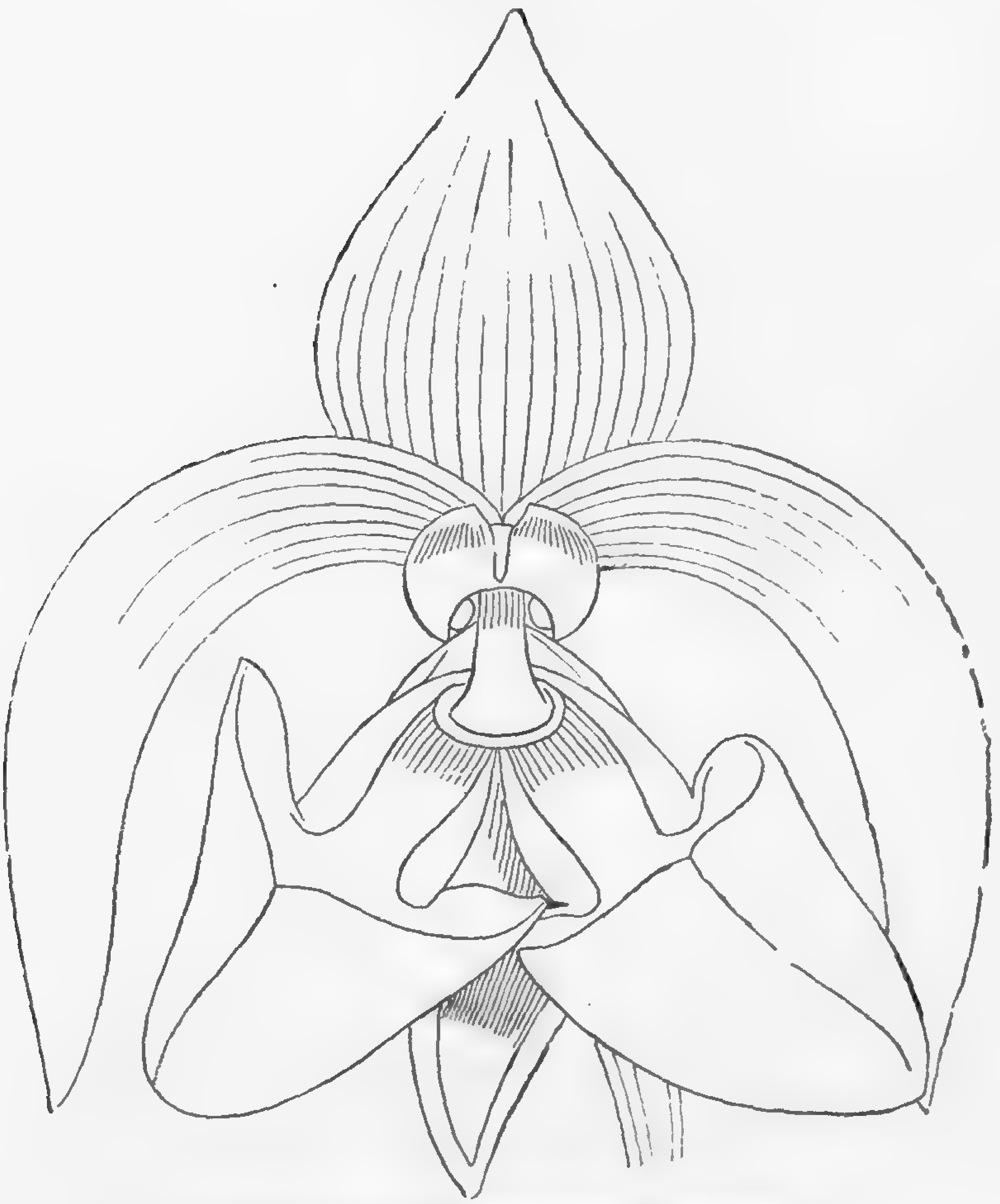
Monandrous and diandrous flowers have been already alluded to ; so that I may now pass on to flowers in which the number of stamens was greater.

PLEIOMERY.

II. *Increased Number of Parts.*—This is illustrated by the occasional presence of an increased number of lips. This augmentation may be due to an actual increase in the number of petals, to a division of one petal into two, or, more frequently, either to the development of the lateral petals in the form of lips, or to the appearance of one or more of the stamens in the guise of labella. An instance of increased number of petals in *Cypripedium superbiens* was lately communicated to me by Mr. James. In this flower the sepals, andrœcium, and the gynæcium were all normal; but the corolla was represented by four petals, the two lower ones in the form of lips (see figs. 3, 4). Possibly these were not really two labella, but were constituted of one dividing into two at a very early stage; but this could not be determined in the adult flower.

Plurality of the stamens occurs in different degrees. Hitherto I have not met with any absolute increase in number beyond the typical six; but I have now met with instances of the presence in *Cypripedium* of from one to six stamens in different flowers, either in a fertile or in a petaloid condition, and upon some of these I shall now comment.

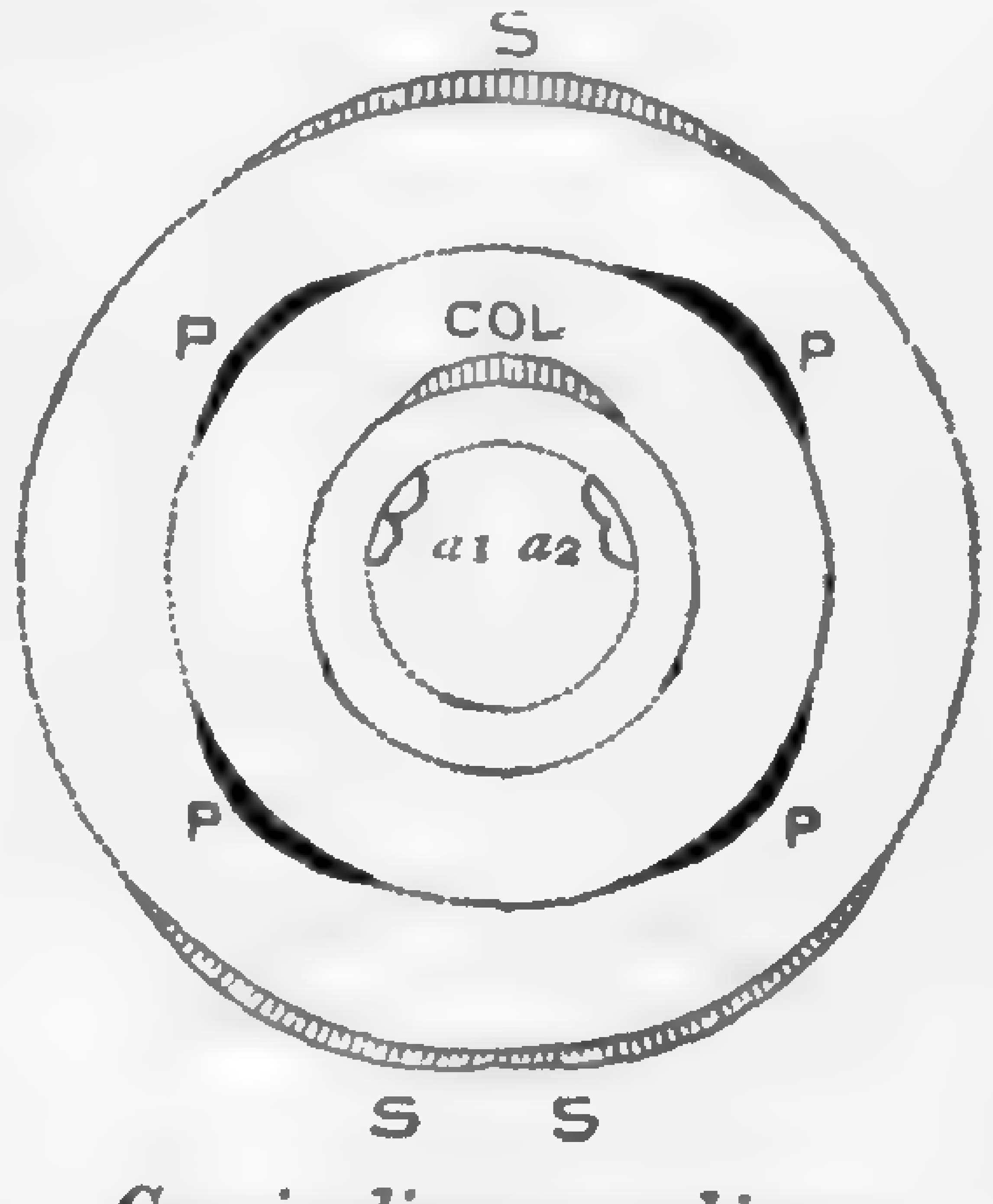
Fig. 3.



Two-lipped flower of *Cypripedium superbiens.*

Triandrous Flowers.—Magnus* describes a triandrous flower in *Cypripedium barbatum*; and I have seen a flower of the same species shown me by Mr. Lowne also with three stamens, viz. A1, *a*1, *a*2. In two flowers of *C. Lawrenceanum* (fig. 5), received from Mr. Stevens, the perianth was tetramerous and dicyclic, while the andrœcium was trimerous, the outer median stamen, A1, being fertile, and the two lateral stamens of the inner series, *a*1, *a*2, represented by shield-like staminodes, thus exactly reversing the

Fig. 4.

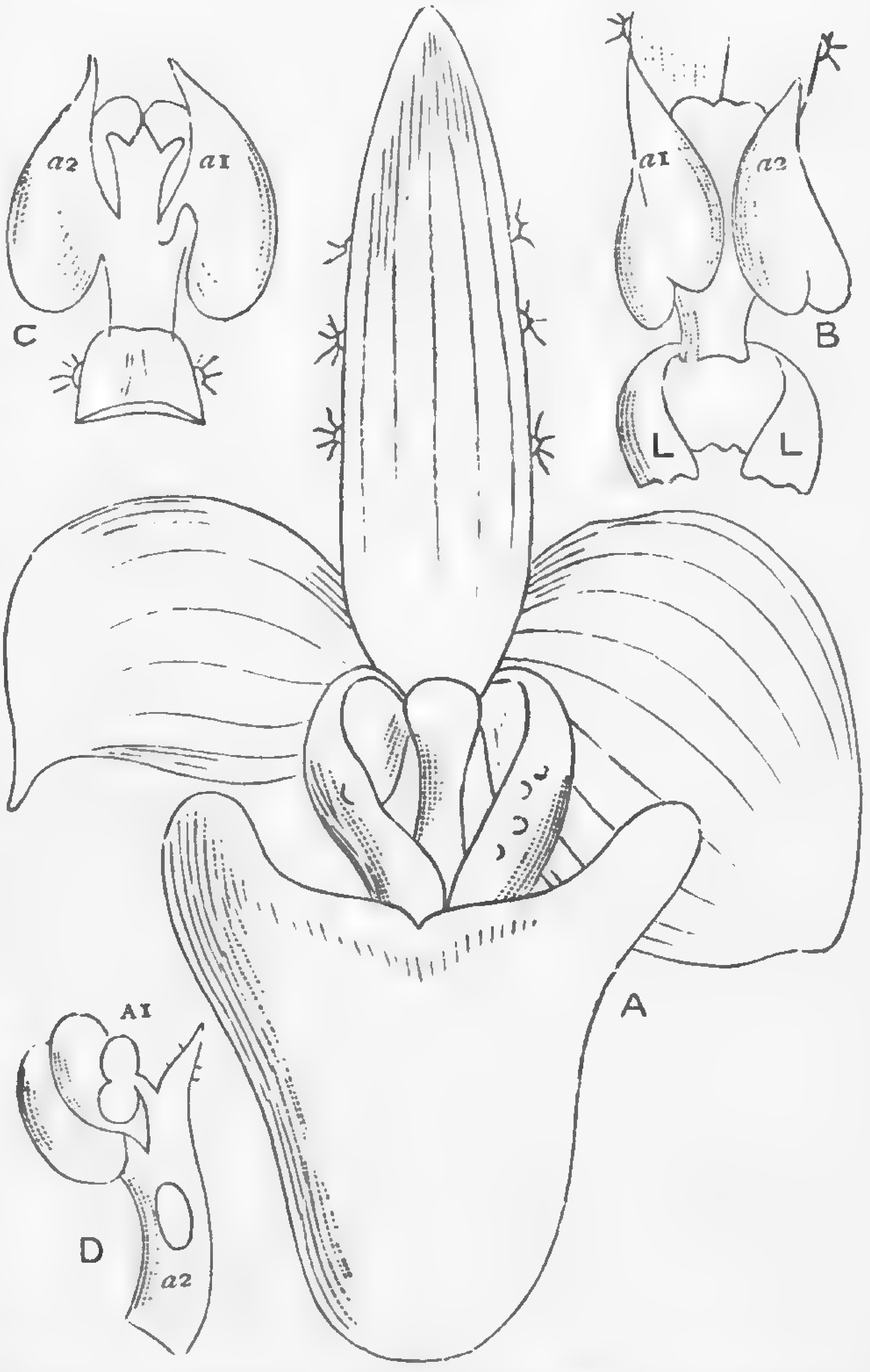


Cypripedium superbiens.
Plan of flower (fig. 3).—S, sepals; P, petals; COL, column or staminode; *a1*, *a2*, inner fertile stamens.

* Sitzungsber. d. Gesellsch. Nat. Freund. Berlin, June 18, 1878.

ordinary staminal arrangement in this genus. The stigma, G1, was superposed to the median fertile stamen. In a specimen of *C. Spicerianum* sent to me by Mr. Fraser, the three sepals were free, and the andrœcium was represented by the three stamens of the inner row *a*1, *a*2, *a*3 all fertile. In *C. Sedeni* × I have also seen all three stamens present in the case of flowers the subject of regular peloria to be hereafter mentioned.

Fig. 5.



Flower of *Cypripedium Lawrenceanum*, with 4-parted perianth and three stamens, one outer, A1, fertile, two lateral, *a*1, *a*2, barren. A, flower; B, column, from the front; C, column, from the back; D, column, from the side, one of the staminodes, *a*2, removed.

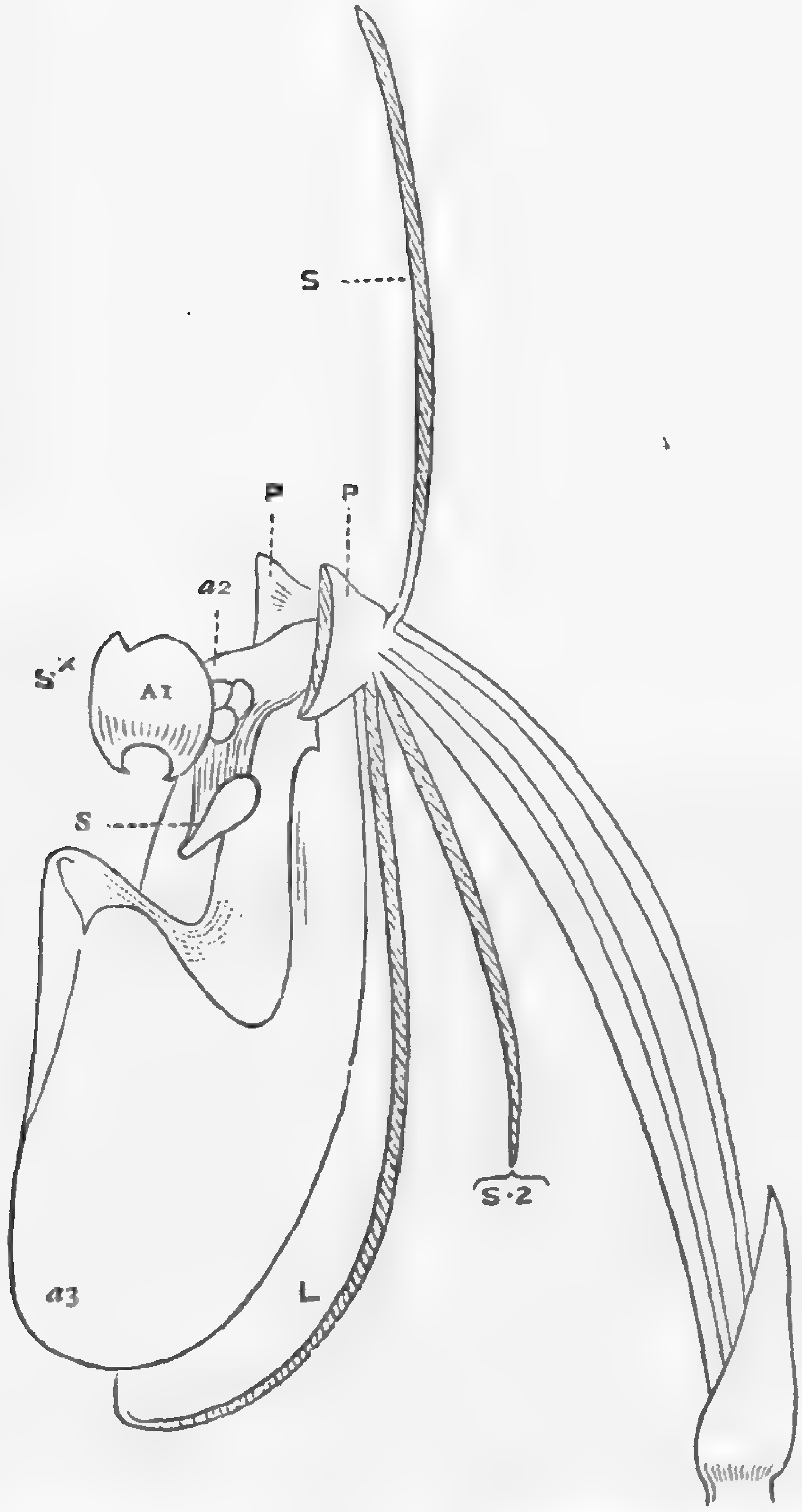
Tetrandrous Flowers.—In *Uropedium* there are at least four stamens present, viz. A1, as a staminode, and *a*1, *a*2, *a*3 fertile. The staminode in this case may possibly represent A2 and A3 as well as A1. Asa Gray describes* a tetrandrous flower of *Cypripedium candidum*; and I have lately examined a flower of *C. Lawrenceanum* in which there were four stamens present, viz. A1 as a staminode, *a*1, *a*2 fertile, and *a*3 developed as a lip, which was, as it were, slipped within the cavity of the true lip, so that there were two lips one within the other (figs. 6 and 7).

In a *Cypripedium* sent me by Mr. Haywood there were also

* Seemann's Journ. of Botany, iv. (1866) p. 378.

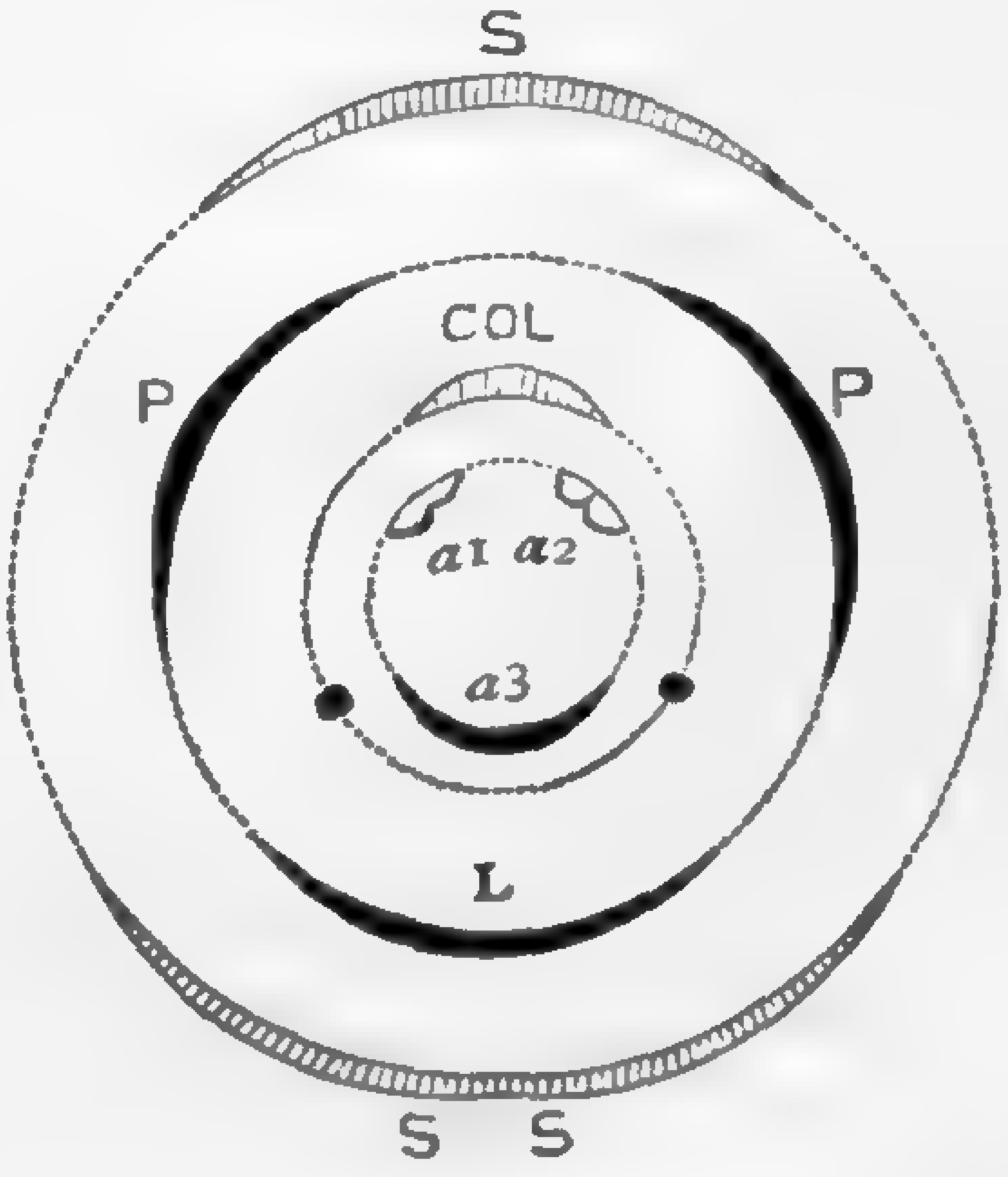
four stamens—A1, *a*1, and *a*2 developed as flat petals, while *a*3 was present in the form of a small lip. In this case not one of the stamens was fertile; but all were petalodic, as was also one of the styles G1, thus affording an instance of a double-flowered *Cypripedium** (fig. 8, p. 414).

Fig. 6.



Cypripedium Lawrenceanum.—Flower in section, with some of the parts removed to show one lip, *a*3, enclosed within the normal one L. S, sepals, the two lower ones concrescent; P P, petals cut across at their base; A1 staminode; S, stigma.

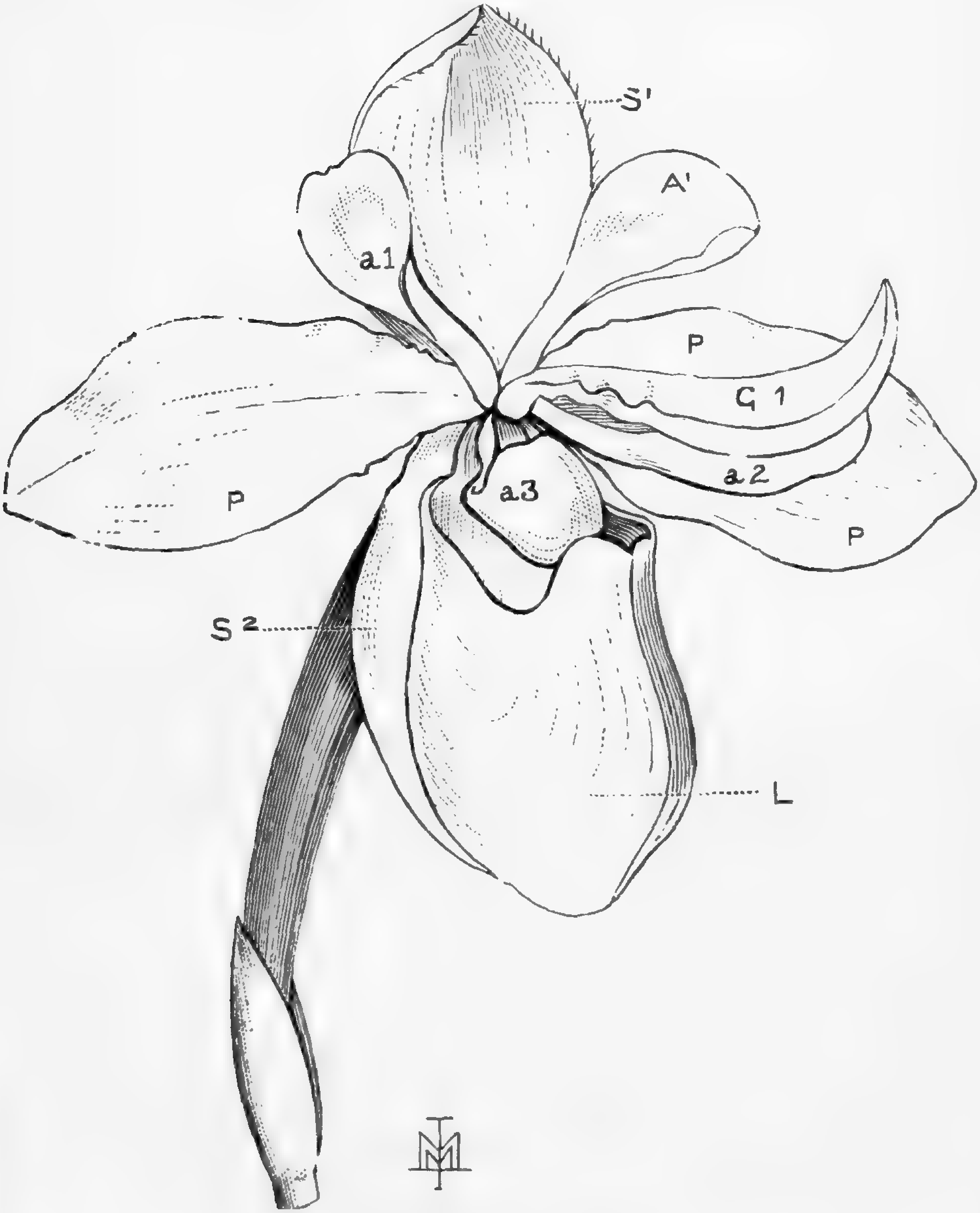
Fig. 7.



Cypripedium Lawrenceanum. Plan of arrangement of parts.

* Masters in Gard. Chron. May 9, 1885, p. 597, fig. 112.

Fig. 8.



A double-flowered *Cypripedium.*

S1, S2, sepals; P, P, petals; L, lip; A1, outer petal-like stamen; *a*1, *a*2, *a*3, three inner stamens, of which two are petal-like and one lip-shaped; G1, a petal-like style.

Hexandrous Flowers.—Last in the series may be mentioned a flower of *Cypripedium Sedeni* × in which all six stamens were present, two fertile, A1 and *a*3, opposite one another, while all the others were represented by saccate lips (irregular peloria).

Tendency to Increase the Inner Row of Stamens.

It is perhaps worthy of note that in the numerous cases I have examined, wherein the number of stamens in Orchids generally has been increased, the increase has been relatively more frequent in the inner staminal cycle than in the outer; thus, in my experience, it has been more common to find the inner series a_1, a_2, and even a_3, developed either in a fertile or in a petalodic condition than it has been to meet with corresponding changes in the outer series A_1, A_2, A_3. The frequent abortion of the outer row may be indeed induced by the necessities of space, or by the rhythmic alternation of activity and quiescence, which is so marked a feature in plant-life. In the nearly allied groups Burmanniaceæ and Apostasiaceæ the inner row of stamens is the one most usually developed, as it is also in Restiaceæ and Xyridaceæ; while in Iridaceæ, on the contrary, it is the outer episepalous row which is usually present, and the inner row is absent*.

Partition.

Under this heading may be included those cases in which an organ, primitively simple, becomes, in course of development, more or less divided by a so-called process of fission. They require to be carefully discriminated from instances of dialysis, or the separation of parts usually concrescent or inseparate. An illustration of this partition was afforded by a flower of *Cypripedium Spicerianum* forwarded by Mr. Hansen. In this flower the dorsal or median sepal, usually entire, had two distinct midribs and a shallow notch at the apex; the lower united sepals, the petals, the lip, the inner row of stamens a_1, a_2, and the stigma, G, were all of the usual form and appearance. The staminode, however, was divided to the base into two polygonal, shield-shaped lobes occupying a lateral, not a median, position. At first sight, therefore, it seemed as if the usual staminode representing A_1 were absent, while the other two of the outer row A_2, A_3 were present in the form of petaloid shields. In fact, the appearance was exactly the same as in certain flowers mentioned in this communication in which the two side stamens of the inner row, a_1, a_2, were represented by shield-like staminodes.

* For a case in which the inner staminal series in *Iris* was developed, see Heinricher, Sitzungsb. der k. Akad. Wissensch. Wien, November 3, 1881, p. 509, separate paper, p. 51, tab. v.

That they did not, however, in this case, belong to the inner row was manifest, because the inner row was present in its normal state and position. Moreover, their insertion was distinctly external to that of the fertile stamens, while the back of the column presented a well-marked central ridge concealing a single central vascular bundle, which, near the apex, divided into three divisions—one central, minute, and two lateral, passing into the petal-like shields. The minute central portion evidently represents the central branch of the filament which in ordinary Orchids bears the anther, while the two lateral lobes are side-outgrowths from the same filament, thus resembling the trifid stamen of *Allium*, in which the central division bears the anther. Again, the indications of fission in the median sepal correspond to the similar division of the staminode superposed to it. Indications of this bipartition, or rather tripartition, of the posterior or median staminode are common in many species of *Cypripedium*, which present a central knob or boss and two lateral lobes.

On making sections through the peduncle, above the insertion of the bract, a ring of six vascular bundles was seen. At the base of the ovary the posterior bundle bifurcated; and this twin bundle was traced throughout the whole length of the prominent ridge forming the dorsal suture of G_1, and in to the median sepal S_1, where the bundles formed the double midrib. A similar section across the column at its base also showed six bundles, five single and one bifurcated; this bifurcated bundle passed into A_1, its two divisions passing into the shield-like divisions of the staminode. Thus the partition began at the base of the flower in the posterior median line, and continued in it all the way up; so that whereas, under ordinary circumstances, the arrangement in the median line would be—

S_1
A_1
G_1
L

in the particular flower now under consideration the arrangement was—

S S
A A
G G
L

the gynæcium being only partially implicated, and the lip not at all.

Displacement.

III. *Change in Position of Parts.*—This has already been incidentally alluded to in connection with the reduced number of parts; but the importance of the subject necessitates some further mention. In the dimerous forms of *Cypripedium* the upper or median sepal is usually absent, the lateral ones are

present, either separate, when each occupies a truly lateral position, or united from concrescence, when the conjoined pair occupy a median, inferior, or anterior position. In these flowers the side petals are absent, the petalline whorl being represented by a single median petal opposite to the lip, as shown in Mr. Le Marchant Moore's monandrous *Cypripedium*, and in those figured in this communication, and as commonly happens when the flowers of Orchids are dimerous. Professor Charles Morren* describes and figures a flower of *Cypripedium insigne* in which, by torsion of the axis, the inner sepal had become lateral, and, by a further twist, one of the lower sepals was made to occupy the position of one of the lateral petals. Of the two side petals, one was completely absent, while the other, by a continuance of the twisting process, was placed in a median position opposite to the lip. All the stamens were absent except one of the inner row, apparently what we should now designate as a_1. Morren cites this flower as an instance of what he terms "spiranthy." The flower may probably have been susceptible of other and simpler interpretations than that offered by the Belgian Professor; but it is unnecessary to enter into the question here, where the only object is to cite the flower as an instance of displacement of parts and of a monandrous condition.

In a flower of *C. Lawrenceanum* given me by Mr. O'Brien the flower had a peculiar oblique lopsided appearance by reason of the lateral petals being united with the upper sepal; and while the sepal was, as it were, dragged downwards, the petal was correspondingly raised; the consequence being that neither part occupied its natural relative position, 90°, but one was about midway between the two, *i. e.* 45°. The other lateral petal was normal in form and in position.

Peloria.

IV. *Tendency towards Regularity of Form and Arrangement of Parts, or Peloria.*

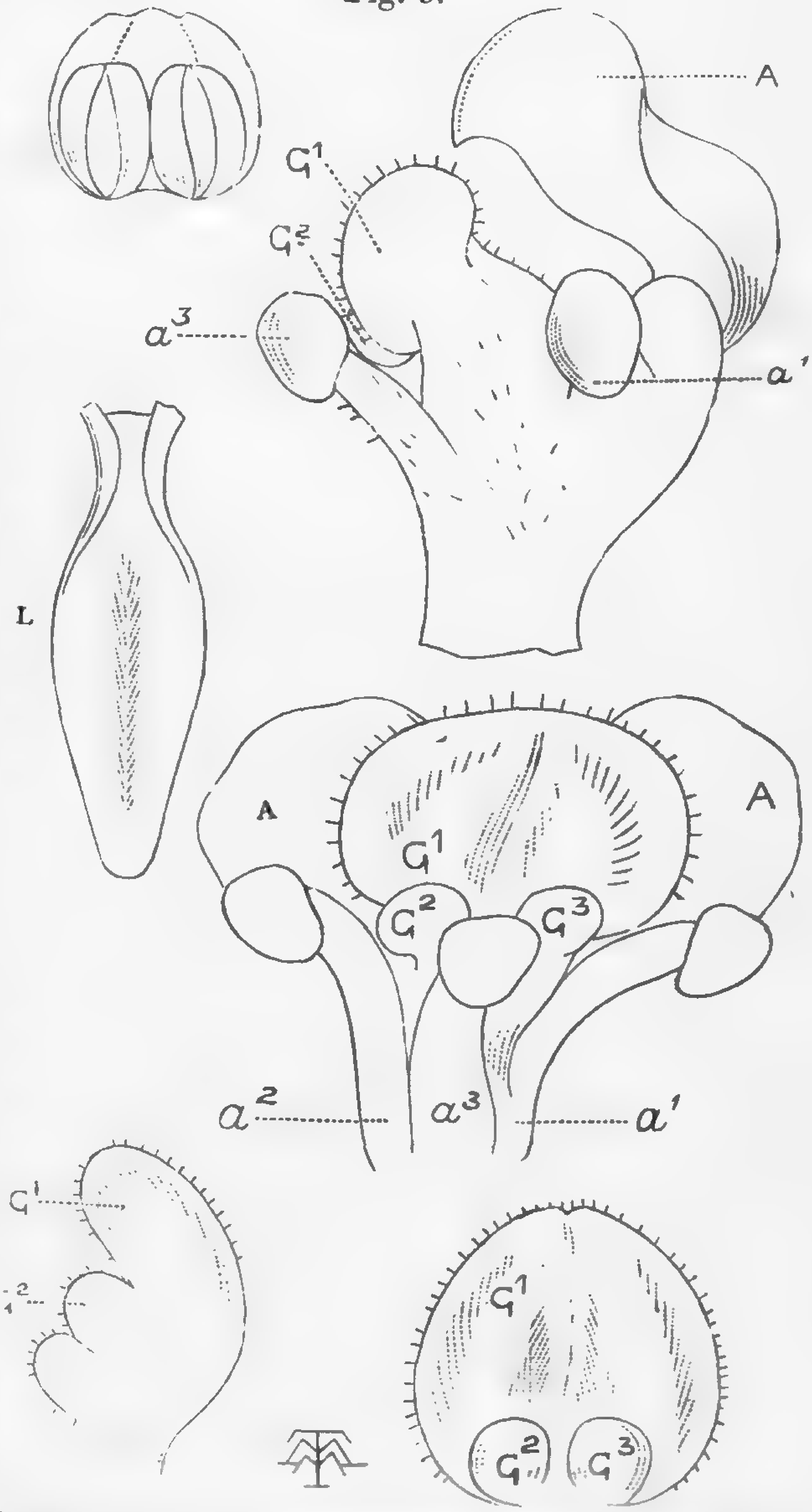
Peloria in *Cypripedium*, as in other plants, is either:—*α*, *Regular*, when the tendency to regularity is brought about by an increase in the number of regular portions, a tendency which seems to be a reversion to a simpler and probably primordial condition, as is the case perhaps in *Uropedium*; or, *β*, *Irregular*, when symmetry is restored by the development in an irregular

* Bull. Acad. Roy. Belgique, t. xviii. p. 196, tab.; *Lobelia* (1851), p. 55.

form of parts which are usually regular. Irregular Peloria, when not associated, as it sometimes is, with compensatory defect in other whorls, may be regarded as an instance of enhanced complexity and of potential progressive development. The opposite view, that the most highly complex is the form whence the less differentiated case of regular peloria is derived by a process of degeneration, finds, so far as I know, no warranty, either in organogeny or in anatomy.

Regular Peloria.—Prof. Asa Gray, as before mentioned, has described a case of regular peloria in *Cypripedium candidum* associated with a reduced number of parts, forming thus a regular symmetrical and complete, but dimerous, Orchideous flower—the first verticil of stamens barren, the second antheriferous, and alternating with the carpels. Here we have, as Gray remarks, "clear, and perhaps the first, direct demonstration that the Orchideous type of flower has two staminal verticils, as Brown always insisted."* Mr. Tautz has lately furnished me with a specimen of *Cypripedium* (or *Selenipedium*) *Sedeni* ×,

Fig. 9.

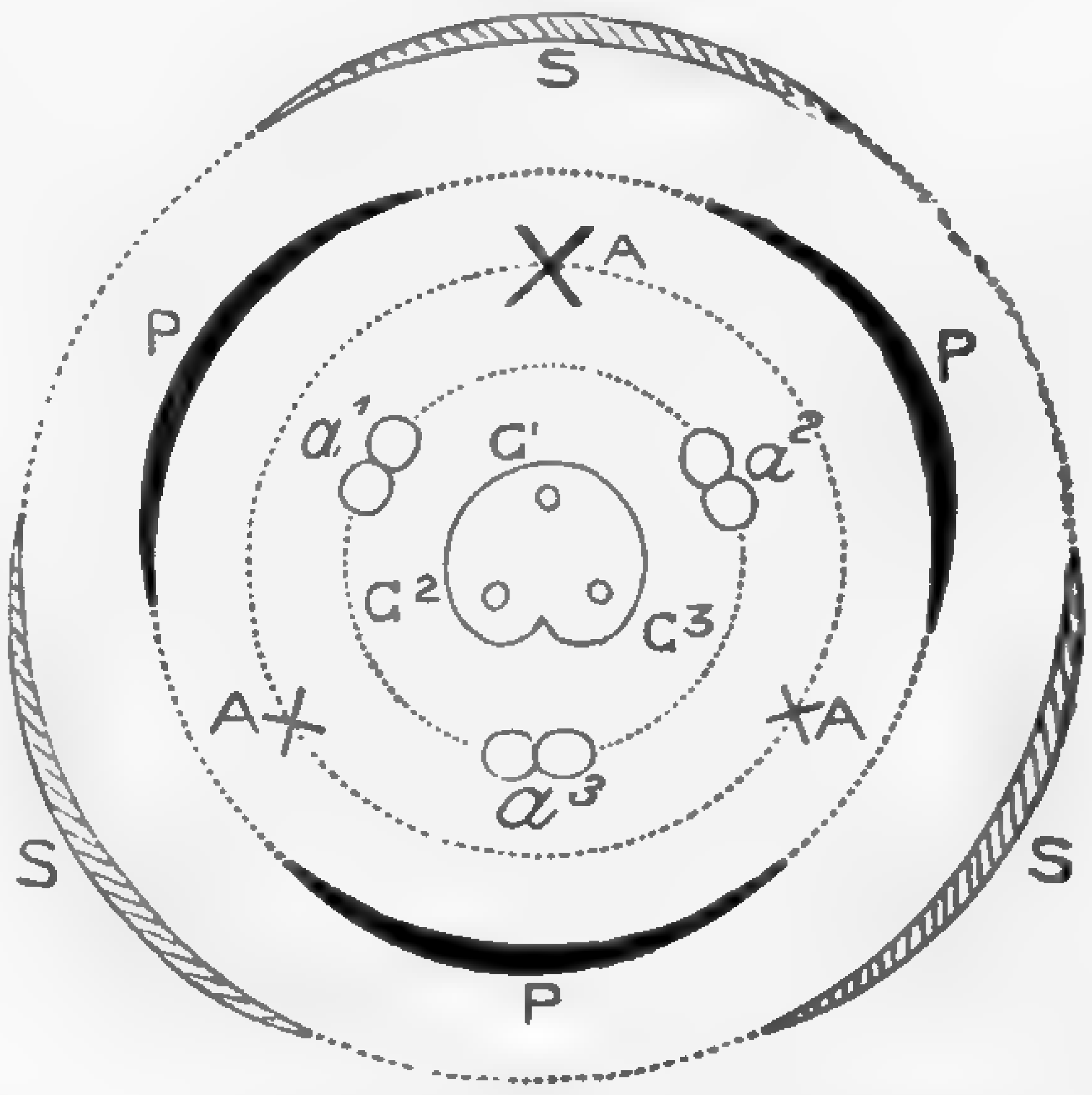


Peloriate flower of *Selenipedium Sedeni*. Column, from beneath and from the side, anther, lip L, and stigmas G^1, G^2, G^3. All magnified.

* Gray in Seemann's Journal of Botany, vol. iv. (1866) p. 378, reprinted from 'American Journal of Science,' xlii. July 1866. See also Magnus, 'Sitz-

in which there were three free sepals, two lateral petals, and one flat lip, like the other petals in shape but broader. The column had the usual staminode A× and two fertile stamens, a_1 and a_2, with, in addition, a third stamen a_3, projecting in front of the stigma. The stigma itself was three-lobed, the posterior lobe G_1 being of the usual large size, the two lateral lobes smaller (see figs. 9, 10). The formula for this very interesting flower is thus 3S 3P × 3a 3G. The usual zygomorphic state was replaced by an actinomorphic condition, as is met with in some Dendrobes, *Paxtonia*, *Thelymitra*, *Phalænopsis*, *Telipogon*, &c. Endlicher's *Thelychiton* (Endl. Gen. 1616) may also be mentioned as a pelorioid form with a regular perianth and a cup-like andrœcium, one lobe of which bears an anther.

Fig. 10.



Plan of peloriate flower of *Selenipedium* (see fig. 9).

In a specimen of *C. caudatum* sent me by Mr. Bull (see Plate XX.) the three sepals were free, the lateral petals as usual prolonged into the long tails, which constitute so remarkable a feature of the species, while the median petal, instead of having the form of a long sac, something like the finger of a glove, was partially flattened out and partially contorted—presenting, in fact, an intermediate condition between that of the ordinary lip and that of one of the ordinary lateral petals. The median stamen of the outer row, A_1, was present as a staminode; and the ear-like process on either side of it *possibly* represented the two lateral stamens of that series, A_2, A_3, though, from the analogy of other cases, I am more disposed to regard them as sterile branches of A_1, and to consider that A_2, A_3 were absent. The three inner stamens, a_1, a_2, a_3, were all present and all fertile. The ovary was, as customary in this plant, 3-celled. So that there was in this flower a tendency towards regular peloria, and

ungsber. d. Botan. Vereins d. Prov. Brandenburg,' xxi. January 31, June 27, and November 28 (1879); also his "Kurze Notiz über dimere Zygomorphie Orchideenblüthen und über ein monstroses *Cypripedium*," in the Abhandlung. d. Bot. Vereins Prov. Brandenburg, xxi. p. 97.

a reversion to the (assumed) primitive type, as manifested by the dialysis of the sepals (which, it may be incidentally mentioned, occurs normally in the Canadian *C. arietinum*), partial regularity of the lip, and the presence of the third or median stamen (a_3) of the inner row. The usual absence of this stamen seems to be correlated with the great development of the labellum. The stigma G_1 (marked S^M in the drawing) was superposed to a_3, either owing to the non-development of G_2 and G_3, or, judging from other cases previously mentioned, it might have been really compounded of G_2 and G_3. Unfortunately the arrangement of the vessels in the stigma of this flower was not examined.

In the flower in question the labellum was less highly organized than usual, and the stamen a_3 consequently had more space wherein to develop, and thus the defect of the one was, to use Sir Thomas Browne's expression, "pierced out by the excess of the other." The close resemblance to *Uropedium** in Mr. Bull's flower was manifest in the dialysis of the sepals, the tendency in the lip to become regular, and in the presence of all the stamens of the inner cycle. In the Bulletin of the Amsterdam Botanical Congress, 1865, p. 62, Prof. Reichenbach describes a flower of *Selenipedium caudatum* in which the lip was undulated and twisted, bearing at its point a little thickening, as at the orifice of the bag-shaped lip. "If," says M. Reichenbach, "this flower had shown an anther in front of the labellum, it would have proved the identity of the two types (*Selenipedium* and *Uropedium*); but the flower, in spite of the petaloid nature of the labellum, had the column of *Selenipedium*, and on that account offers additional argument in favour of the distinctness of the two genera." In the specimen above described the third stamen was present in front of the lip, and so far it satisfied Prof. Reichenbach's postulate. For a figure of a very similar malformation in *S. caudatum* see also Reichenbach fil. in Nov. Acad. Nat. Cur. xxxv. (1870), n. 2, c. tab. In Reichenbach's plant the three sepals were not separate.

Irregular Peloria.—Cases of partial irregular peloria in *Cypripedium* are not very uncommon, as, for instance, flowers in which the lateral petals (or one of them) assume the saccate form of the lip. This may occur without any increase in the number of parts, or, on the contrary, some of the usually undeveloped

* *Uropedium*, see Brongniart, in Ann. Sc. Nat. sér. 3, xiii. p. 113; Reichenbach fil., 'Xenia' (1858), t. i. tab. 15; Bot. Zeit. 1876, p. 41.

stamens may be present in the form of lips, as in a flower of *C. Sedeni* ×, previously mentioned.

The change from the ordinary zygomorphic or irregular form to a state of actinomorphy or regularity is thus shown, not only in the equalized form and size of the parts of the flower, but also in their regularity of arrangement, either in a binary and decussate or in a ternary radiating manner. Whether the peloria be regular, or whether it be irregular, the result is thus seen to be the same—a zygomorphic flower becomes actinomorphic.

Combination of Tendencies.

The changes just referred to may occur separately, but it is more common to find them associated with others: thus an increased number of stamens is associated with regular peloria, and sometimes with independence of the sepals, as in Mr. Bull's specimen, or it may be that the increase in the number of stamens is connected with their development in the form of lips, as in irregular peloria. In irregular zygomorphic flowers, or in those which show a tendency to become so, it often happens that if one part, say the median sepal in *Cypripedium*, is larger than the lateral petals, the part opposite to it in the succeeding whorl is also larger than its fellows: thus in *Cypripedium* the large median or dorsal sepal is on one side of the flower, the largest petal (the lip) on the other; the large shield-like staminode is on one side, the large stigma on the other. This is of course a frequent tendency in flowers, as in *Eremophila*, where one large sepal is placed on the opposite side of the flower to the largest lobe of the corolla.

Changes resulting from Hybridization.

The *Cypripedium Sedeni* ×, which presents so many monstrous conditions, is a hybrid raised in Messrs. Veitch's nursery, between *C. longifolium* and *C. Schlimii*, Rchb. f., in Gard. Chron. (1873), p. 1431. By its 3-celled ovary it falls into the section *Selenipedium*, which some prefer to consider a distinct genus, not only for structural, but also for geographical reasons, as it is the tropical American representative of the tropical Asiatic group. It is noteworthy that, according to Mr. Seden, the raiser, *Cypripedium Sedeni* × is produced whichever species be used as the seed-parent. Whether *C. longifolium* be fertilized by the pollen of *C. Schlimii*, or the reverse, the result is the same*. The

* Reichenbach, in Gard. Chron. *l. c.*; Veitch Orchid Conference Report, Journ. R. Hort. Soc. Lond. vii. (1886) p. 30.

petals of the hybrid are in form like those of *C. longifolium*, while their colour is that of *C. Schlimii*.

The changes which occur in this and other hybrid plants and their derivatives may be ranged under three categories :—

1. Those in which there is an intermixture of parental characteristics, in varying degrees, but without any material change in the floral symmetry. The changes, in fact, occur in those characters which are more or less directly of an "adaptive" nature.

2. Those in which there is in the offspring more or less dissociation of the hybrid or mixed characters of the parents, so that the plant reverts more or less completely to one or other of its immediate parents, as pointed out by Naudin.

3. Those in which the change is decidedly teratological, and more or less affecting those "congenital" characters which constitute the symmetry of the flower. These may be: 1, reversions to an ancestral form, in which the structure was simpler, less differentiated, the parts possibly more numerous, and isolated rather than inseparate; or, 2, they may possibly be indications of the direction in which progressive modifications may take place in the future.

EXPLANATION OF PLATE XX.

Peloriate flower of *Selenipedium caudatum*, real size (see p. 419). A, section of ovary, magn. 4 diam.; B, side views of column, enlarged 3 times. A_1 A_2 A_3, staminode; A_2, A_3 are probably not separate stamens of the outer row as the lettering would indicate, but merely subdivisions of A_1; a_1, a_2, a_3, fertile stamens of the inner row; S_M, stigma. In the plan the signification of the letters is the same.

Berberidearum Japoniæ Conspectus, auctore Tokutarō Itō. (Communicated by W. T. Thiselton Dyer, C.M.G., F.R.S., F.L.S.)

[Read 4th November, 1886.]

(Plate XXI.)

Notas quæ de Japonicis Berberidaceis sequentur auctor composuit eo tempore quo in Herbario Kewensi Aprili præsentis anni suum 'Florula Fudsisanensis' parabat, cujus partem hæc constituit. Quum tamen rem diligenter cogitavisset in conclusionem pervenit si tales notas intra fines floræ localis inseruisset hanc de toto esse permixturum sed amicis eximiis cll. Prof. Dan. Oliver et W. T. Thiselton Dyer benigne consulentibus auctori per-

suasum est ut notas seorsum poneret. Quamquam auctor Berberidacearum omnes species in Japonia cognitas includere statuerat notas in monographiam tam elaboratam componere non in ejus consilium venit. Maximi autem momenti observationes de hac familia in iis invenientur. Diligens erat præparatio, defectum tamen de multis rebus, genere præsertim *Epimedio*, auctor timet.

STAUNTONIA, *DC.*

Duæ species ante cognitæ, alia Japonica, alia Chinensis, inter se conjungi a me existimantur; una ergo tantum species huic generi est relicta.

ST. HEXAPHYLLA, *Decne. Ann. Sc. Nat.* xii. 1839, 105 (2ᵉ série); *Sieb. et Zucc. Fl. Jap.* i. 140, tab. 76; *Fam. Nat.* n. 359; *Miq. Prol.* 197; *Franch. et Sav. Enum.* i. 21, n. 92; *Engler, Bot. Jahrb.* vi. 1885, 581.—Rajania hexaphylla, *Thunb. Fl. Jap.* (1784) 149.—Ya-mokkwa, Tokiwa Akebi, *Shimada Yōnan, Kwa-wi, Arb.* iii. fol. 2.—Mubé, *Iwasaki Tsunemasa, Honzō Dsufu,* vol. xxx. fol. 10 recto; *Itō Keiske, Nihon Sanbutsushi, pt. prov. Ōmi,* ii. fol. 14–15, cum icone. Id., *Koishikawa Shokubutsuyen Sōmoku Dsusetsu, seu Icon. et Descript. plant. in hort. Koishikawa, Arb.* ii. 3, pl. iii.

Hab. in *Japoniæ* insula Kiusiu: prope Nagaski (*Oldham!* 1862, n. 536 in part, flor., 1863 n. 32 flor., et n. 33 fructif.). In principali insula: mult. provinciis Ōmi, Yamato, Ise (monte Asakuma-yama), Kii (Kumano) et alibi (*Itō Keiske, locc. citt.*); circa Yokosuka (*Savatier*, n. 46). In archipel. Riukiu, ins. Ōshima (*Döderlein ex Engler*).

Corea: ad portum Hamilton (*C. Wilford!* 1859, n. 338 flor.).

Japonice: Tokiwa Akebi, i. e. *Akebia persistens.*

β. CHINENSIS, *DC.* (sp. pr.), *Syst.* i. 513 (1818); *Prodr.* i. 96; *Decne. loc. cit.* 107; *Bentham, Fl. Hongk.* 14.

Hab. in *China* (*Fortune!* 1845, n. 166 flor.): Hongkong (*Wright!* flor., *Champion!* flor. et frf., *Wilford!* 1858), montibus Gough et Victoria (*Wilford!* Feb. 1885, n. 338 flor.).

Distinctio inter *St. hexaphyllam*, Decne., et *St. chinensis*, DC., est valde obscura. Decaisne, Annales des Sciences Naturelles, 2ᵉ série, t. xii. 1839, 105, differentiam inter duas species monstravit: illam "foliolis lanceolatis mucronato-setaceis," hanc "ovali-oblongis integris." Sed et Chinensis et Japonicæ plantæ folia sunt valde variabilia, atque specimen *St. hexaphyllæ*, quod

ab Oldham in Nagasaki lectum (n. 32) in herb. Kew. vidi, ovali-oblongis, emarginatis, sed specimen Hongkongense (n. 43), *St. chinensis* foliolis 3–7 lanceolatis, acuminatis, vel oblongo-ovatis, emarginatis, vel juvenalibus mucronato-setaceis mihi videtur. Variabilitas foliorum a Benthamio in Flora Hongkongensi, 14, jam demonstrata est, qui dixit folia magnitudine valde variabilia esse, superiora plerumque foliolis circiter 5 obovatis, aut ovali-oblongis, circiter 2 poll. long., cum petiolulis ½ poll., sed inferiora sæpe foliolis 6 vel 7 oblongo-acuminatis.

Itaque duas species vix differre et in unam conjungendas mihi videtur. Sive *St. chinensis* varietas *St. hexaphyllæ* seu forma tantum sit investigandum est. *Quamquam in præsentia eam colloco varietatem, forma tantum forsitan est.*

Cl. Maximowicz qui nuper scripsit "accurata est diligentia tua de *Stauntonia*" mihi notas ineditas benigne transcripsit, quas infra dedi :—

St. chinensis.—St. chinensis et *St. hexaphyllæ* de differentia suum dubius. Differentem nominat Decaisne eam foliorum et mucronis formam quam unam et eandem comperi. Benthami autem descriptio cum altera specie æque ac altera congruit, exceptis purpureo-viridibus floribus, sed Wright (in schedula plantæ Hongkongensis) albos flores nominat. Denique distinctio sequens, a Candolleo data superest quæ probabiliter æque mala:

Foliola utrinque elevato-reticulata ..	*St. hexaphylla.*
Foliola superne lævia	*St. chinensis.*

Cll. F. B. Forbes et Hemsley mihi roganti benigne responderunt, foliorum reticulationem esse in eadem planta cujus folia venas immersas habeant. Id quod præterea meam existimationem de unitate *St. hexaphyllæ* et *St. chinensis* confirmat.

AKEBIA, *DC.*

1. A. QUINATA, *Decaisne, loc. cit.* 107; *Sieb. et Zucc. Fl. Jap.* i. 143, tab. 77; *Fam. Nat.* n. 355; *Miq. Prol.* 197; *Franch. et Sav. Enum.* i. 21, n. 88.—Rajania quinata, *Thunb. Fl. Jap.* 148.—Akebi, *Iwasaki Tsunemasa, Honzō Dsufu*, vol. xxx. fol. 8 verso.—Tsuneno Akebi, *Itō Keiske, Sōmoku Dsusetsu, Arb.*, vol. ii. 1, pl. 1.

Hab. in *Japonia* (*Buerger*! sub nom. *Rayana quinata*, Thunb., comm. ex herb. Lugd.-Bat. in herb. Kew. flor.); Kiusiu, circa

Nagasaki (*Thunberg*, *Oldham*! April. 1862, n. 536, flor. et frf.). In principali insula: ad Yokohamam (*Maximowicz ex Franchet et Savatier*; *Oldham*! Juli. 1881, n. 217 fructif., *Dickins*! fl.); Kioto (coll. 'Challenger' Expedit.! April. et Mai. 1875, flor. in herb. Kew.); in montibus Nikkō et Fudsi-no-yama (*Maries*! flor.); circa Yokosuka (*Savatier*, n. 48).

Korea: Chemulpo (*W. Charles*! n. 14 et 46 flor.); ad portum Hamilton (*Oldham*! n. 34, Mar. 1863, cum floribus foliisque juven.).

China (*Fortune*! n. A 31, 1845, flor.): Ningpo (*Everard*); ad Nin-kan-jou (*W. Hancock*! 22 April. 1877); Kiu-Kiang (*Dre. Shearer*! 1873, flor.). Herb. J. Gay! in schedula sub "Jardin des plantes, école, le 28 Avril, 1858, Originaire de Chine," in herb. Kew. vidi.

Japonice: Akebi.

2. A. LOBATA, *Decaisne, loc. cit.*; *Sieb. et Zucc. Fl. Jap.* i. 145, tab. 78; *Fam. Nat.* n. 356; *Miq. Prol.* 197; *Franch. et Sav. Enum.* i. 21, n. 89; *Engler, Bot. Jahrb.* vi. 1885, 58.—Mitsuba Akebi, *Iwasaki Tsunemasa, Honzō Dsufu*, vol. xxx. fol. 9 verso; *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 2, pl. 2.

Hab. in *Japoniæ* (*Buerger*! in sched. sub *Rajania trifolia*, Sieb. comm. ex herb. Lugd.-Bat. in herb. Kew.) ins. Kiusiu: circa Nagasaki (*Buerger*, *Textor*); in fruticetis montis Kawarayama (*Buerger*). In principali insula: in monte Hakone (*Siebold* ipse); circa Kōbe (*Moseley*! 'Challenger' Expedit. April. 1875, flor.); frequens circa Yokosuka (*Savatier*, n. 49); Simoda (*Small*! in herb. Columbia Coll. New York); Yokohama (*Dickins*! 1864, flor.); Kioto et Maizuru (*Döderlein* ex *Engler*). Insula Yezo, prope Hakodate (*Maximowicz*, *Dre. Albrecht*! 1861, flor.).

China: Kiu-Kiang (*Dre. Shearer*! 1873, specim. steril.).

Japonice: Mitsuba Akebi, i. e. *Akebia trifolia*.

Variat formis foliorum:—

a. CLEMATIFOLIOLA.—A. clematifolia, *Sieb. et Zucc. Fl. Jap.* i. 146; *Fam. Nat.* n. 357; *Miq. Prol.* 197; *Franch. et Sav. Enum.* i. 21, n. 90.

Hab. in insula Yezo, inde vivam accepit *Siebold*.

Hoc specimen typicum non vidi sed potest fieri ut sit aut formam *A. lobatæ* aut fortasse tantum forma trifoliolata *A. quinatæ*.

β. QUERCIFOLIOLA.—A. quercifolia, *Sieb. et. Zucc. Fl. Jap.* i.

146; *Fam. Nat.* n. 358; *Miq. Prol.* 197; *Franch. et Sav. Enum.* i. 21, n. 91.

Hab. in monte Kimpō-zan (*Itō Keiske*); Yokohama (*Oldham*! Mai. 1863, n. 985, flor.).

Berberis, *L.*

Conspectus specierum.

Racemi 1–4-flori, foliis oblongo-ovatis v. cuneato-ellipticis integerrimis ..	*B. Thunbergii*, DC.
Racemi multiflori, 2.	
2. Foliis integerrimis	*B. Tschonoskiana*, Regel.
Foliis serratis v. setoso-ciliatis, 3.	
3. Foliis ellipticis v. cuneato-ellipticis, spinuloso-serratis	*B. vulgaris*, L., var. *japonica*, Regel.
Foliis oblongo-lanceolatis v. oblongo-ellipticis, dense setoso-ciliatis, brevipetiolatis	*B. Sieboldi*, Miq.

1. B. Thunbergii, *DC. Syst.* ii. 9; *Prodr.* i. 106; *Regel, Descript. plant. nov. Turkest.* fasc. i. 1873, 21.—B. cretica, *Thunb. Fl. Jap.* 146.—B. sinensis, *C. Koch, in Ann. Mus. Bot. Lugd.-Bat.* i. 252; *Miq. Prol.* i.; *Franch. et Sav. Enum.* i. 22, n. 93, ii. 272 (*non Desf.*).—Megi, *Itō Keiske, Nihon Sanbutsushi, pt. prov. Yamashiro,* ii. fol. 15.—Ko Hebinoborazu, *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 6, pl. iv. (fig. var. *α* typica est).

α. typica, *Regel, loc. cit.* 20; *Gartenflora,* 1872, 238.—Foliis rotundato-obtusis, supra viridibus, subtus albido-glaucis.

Hab. in *Japoniæ* (herb. Lugd.-Bat.! in herb. Kew. steril., *C. Wright*!, *Dickins*! Oct. 1881, fructif., hort. Kew. April. 1882, specimen typicum Bot. Mag. t. 6646! flor.); principali insula: Yokohama (*Maximowicz*! iter secundum, 1862, fructif.); Yokosuka (*Savatier*, n. 50); Kintoki (*J. Bisset*! Mai. 1876, n. 19 flor.); ad pedem m. Fudsi-no-yama (ipse).

β. Maximowiczii, *Regel, loc. cit.*; *Franch. et Sav. Enum.* ii. 272.—B. Maximowiczii, *Regel, Gartenflora,* 1872, 238.—Foliis acutis v. rarius obtusis, utrinque viridibus.

Hab. in principali insula: Yokohama (*Maximowicz*! iter se-

cundum, 1862, flor., *Dickins*! n. 904, flor. et fructif.); in montibus Nikkō et Fudsi-no-yama (*Maries*! flor.).

Japonice: Ko Hebinoborazu, i. e. *Berberis minor* (*Itō Keiske*).

2. B. Tschonoskiana, *Regel*! *loc. cit.* 21; *Franch. et Sav. Enum.* ii. 272, n. 2510.

Hab. in principali insula: alpe Nikkō legit Tschonoski! 1864 (*Maximowcz*, iter secundum, ex herb. horti bot. Petrop. in herb. Kew.).

Japonice: Miyama Hebinoborazu, i. e. *Berberis montana* (*mihi*).

Planta in Kiu-Kiang, China, inventa a Maries! n. 206 flor. in herb. Kew. posita est, hinc speciei forma foliorum et aliis characteres proxime congruunt: Japonica et Sinica inter se differunt, quod in hac ramuli sulcati, angulati, spinulosi simpliciter quod in illa ramuli tereti, striati, spinis nullis. Sed Regel (*l. c.* 21) dicit "ramis teretibus, spinis nullis a *B. Thunbergii* et *B. sinensi* facile dignoscitur," quæ sunt illius notæ ut hanc speciem a duabus illis secernat. Id quod fortasse eam esse speciem distinctam probat cui novum nomen *B. Mariesii* m. dari licet.

3. B. vulgaris, *L.*, var. japonica, *Regel*, *loc. cit.* 15; *Franch. et Sav. Enum.* ii. 275.—B. vulgaris, *Thunb. Fl. Jap.* 146; *Miq. Prol.* 364; *Franch. et Sav. Enum.* i. 22, n. 95.—Hebi-noborazu, *Itō Keiske, Nihon Sanbutsushi, pt. prov. Yamashiro*, i. fol. 18.—Tsuneno Hebinoborazu, *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 4, pl. v. A.

Hab. in principalis insulæ regionibus montanis et humidis Provv. Yamashiro, Ōmi, Mino, Shinano, et alibi crescentes (teste Itō Keiske, *l. c.*); prov. Nambu legit Tschonoski! (*Maximowicz*, iter secundum, 1865, flor.); in alpe Nikkō (*Savatier*, n. 2090). In insula Yezo (*Small*! in herb. Columbia Coll. New York).

Japonice: Tsuneno Hebinoborazu, i. e. *Berberis vulgaris* (*Itō Keiske*).

4. B. Sieboldi, *Miq. Prol.* 1; *Regel*, *loc. cit.* 18; *Franch. et Sav. Enum.* i. 22, n. 94.—Hirohano Hebinoborazu, *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 5, pl. v. B.

Hab. in Japonia (*C. Wright*! flor.) loco non commemorato, a bot. indigen. lecta (ex *Miquel, l. c.*); in monte centrali Japoniæ alt. 27,000 ped. (*Maries*!); Fudsi-no-yama (*Itō Keiske, l. c.*,

ipse); alpe Nikkō (*Itō Keiske, l. c.*, *Bisset*! n. 1289, flor. in herb. Kew.). In regionibus montanis insulæ Yezo (teste *Itō Keiske, l. c.*).

Japonice: Hirohano Hebinoborazu, i. e. *Berberis latifolia* (*Itō Keiske*).

Planta Bissetii sine spinis esse videtur, ceteræ partes ex toto *B. Sieboldi*, Miq., congruunt. An planta diversa?

Species exclusa.

B. JAPONICA, *R. Brown, App. Congo*, 22; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 22, n. 96; *Schlechtd. Bot. Zeit.* 1854, 656; *Sieb. et Zucc. Fam. Nat.* n. 290; *C. Koch, loc. cit.*—Ilex japonica, *Thunb. Fl. Jap.* 79; *Icon. Pl. Jap. Decas.* 4, fol. 2.—Mahonia japonica, *DC. Syst.* ii. 22; *Prodr.* i. 109.—O. Hebinoborazu, *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 7, pl. vi., non distincta e *B. nepalensi*, Spreng., videtur.

Ex sententia Itō Keiskei (*l. c.*) hæc planta in hortis Japonensium tantum culta, sponte crescentem non invenit. Tamen a monte Hakusan prov. Kaga originaliter venisse maxime dubium est. Quam speciem ex ea enumeratione quamquam nomen specificum *B. japonicam* gerit excludere necesse est.

Japonia (*Herb. Lugd.-Bat.*! folia una in herb. Kew.). Kiusiu, in hortis Nagasaki (*Oldham*! 1862, n. 686 frf.).

Berberis Bealei, *Fortune, in Gard. Chron.* 1850, 212; *Hook. Bot. Mag.* t. 4852, e China, videtur non differre ab hac specie*.

CAULOPHYLLUM, *Michx.*

C. THALICTROIDES, *Michx. Fl. Amer.* i. 205, fol. 21; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 23, n. 97.—Rui-yō Botan, *Sōmoku Dsusetsu*, vol. vii. fol. 26; *Itō Keiske, Nihon Sanbutsushi, pt. prov. Ōmi*, vol. ii. fol. 3 et 4 (cum iconibus).

Hab. in *Japoniæ* (*C. Wright*! frf.) principali insula: in monte Ibuki, prov. Ōmi; Ono, prov. Shinano; Hagiwara, Suwara et Kurokawa, Kiso; in montibus Komono et Sakamoto, prov. Ise (teste *Itō Keiske, l. c.*); in monte Nikkō, prov. Shimotsuke (*Bisset*! Mai. 1877, n. 981, flor.); in monte centrale Japoniæ alt. 27,000 ped. (*Maries*! flor.). In insula Yezo (*Maries*!

* Determinationem nominis *B. Bealei*, cl. Prof. Babingtonio debeo propterea quod ejus originem a cl. Bakero inquisivit.

fructif.); circa Hakodate (*Dre. Albrecht*! 1862, fructif., *C. Wright*! in herb. Columbia Coll. New York).

In insula *Sachalin*: Dui (*Glehn*! Juni 1861, flor. et fructif.).

Amur (*Maximowicz*! sub nom. *Caulophyllum robustum*, Maxim., flor. et fructif.).

America boreali (*Richardson*! fl. et frf., *Grevith*! flor., *Daubeny*! frf.): Lexington, Kentucky (*Dre. Robert Peter*! April. 1834, flor.); Rochester (*Domina Thakeray*! flor. in herb. Cantab.); Cunnington (*Torrey*! Mai. 1833, flor.); Charloth, Vermont (*C. G. Pringle*! Mai. 1877, fl. et frf.); West Chester, Townsend (*Cleghorn*! frf.); in silvis penitus Kentucky (*C. W. Short*! fl. April., Mai.). Brit. bor. Amer. (*Dre. Hooker*! Franklin Expedit., flor., in herb. Cantab.); Canada (*Domina Dalhousie*! flor.).

Nandina, *Thunb.*

N. domestica, *Thunb. nov. gen. diss.* i. 14; *Fl. Jap.* 147; *Banks, Ic. Kæmpf.* t. 13, 14; *DC. Syst.* ii. 22; *Prodr.* i. 109; *C. Koch, loc. cit.* 253; *Miq. Prol.* 2; *Bot. Mag.* t. 1109; *Franch. et Sav. Enum.* i. 23, n. 98.—Nandsjokf, *vulgo* Natten *vel* Nandin Tsikku, *Kæmpf. Amœn.* 776.—Nanten, *Honzō Dsufu*, vol. lxxxviii. fol. 16–23; *Itō Keiske, Sōmoku Dsusetsu, Arb.* ii. 9, pl. viii. A et B.

Hab. in *Japoniæ* (*Buerger*! flor. comm. ex herb. Lugd.-Bat. in herb. Kew.) principali insula: circa Yokosuka (*Savatier*, n. 53, sub ubi videtur frequens sed verisimiliter introducta, e *Franchet et Savatier*); Yokohama (*Maximowicz*); Simoda (*Wright*! in herb. Columbia Coll. New York). In insula Kiusiu; prope Nagasaki, prov. Hizen (*Oldham*! Mai. 1862, n. 334, sub in hortis). In archipel. Riukiu; ins. Ōshima (*Oldham*! Oct. 1861, n. 334, fructif.). In insula Tsushima freto Corea (*C. W. Wilford*! Mai. 1859, flor. n. 876, sub ‘cult. in hortis’).

China: prope Ningpō (*R. Oldham*! Juni 1861, n. 72, flor.)! Kiu-Kiang (*Dre. Shearer*! 1873, flor.); fl. Pekin (*Dre. Bretschneider*! n. 51 bis, fructif.); Shanghai (*Dre. A. C. Maingay*! 1861 et 1862, n. 299, frf.); portus Chusan (*Cantor*! frf.).

India orientalis (ex herb. Griffith! sub ‘culta,’ flor.) quod specimen cum parvis foliis

EPIMEDIUM, *L.*

Clavis specierum.

Petala calcarata (*Epimedium*)	*E. macranthum*, Morr. et Decne.
Petala non calcarata (*Aceranthus*),	
2. Flores racemosi, folia conjugata, foliola reniformia denticulis sæpius obsoletis	*E. diphyllum*, Lodd.
Flores paniculati, folia ternata, foliola sagittata setoso-ciliata	*E. sinense*, Sieb.

1. E. MACRANTHUM, *Morr. et Decne. in Ann. Sc. Nat.* 2e série, ii. 252, tab. 13; *Lindl. Bot. Reg.* t. 1906; *Paxton, Bot. Mag.* v. 151, cum icone; *C. Koch, in Ann. Mus. Lugd.-Bat.* i. 253; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 23, n. 99; *Baker, in Gard. Chron.* xiii. 1880, 683; *Moore, in Journ. Linn. Soc.* xviii. 1880, 377.—Ikarisō, *Sōmoku Dsusetsu*, ii. fol. 46, n. 45; *Honzō Dsufu*, vol. vi. fol. 11, recto fig. sinistra.

α. TYPICUM.

Hab. in *Japoniæ* (*Siebold* teste *C. Koch*) principali insula: prov. Ōmi, circa lacum Biwa ('*Challenger*' *Expedit.*! April. et Mai. 1875, flor. in herb. Kew.); in monte Hakone, prov. Sagami (*Savatier*, n. 52, teste *Franchet et Savatier*). In insula Yezo, circa Hakodate (*Dre. Albrecht*! 1861–63, flor., *Maximowicz*! 1861, flor.).

China boreali: prov. Shing King (*John Ross*! April. 28, 1876, n. 174, flor. in herb. Kew.); Chiu Kiang et Kiu Kiang (*Maries*! flor.); Changdien-Quandien (ex *Moore*).

β. VIOLACEUM, *Morr. et Dcne.* (sp. pr.), *loc. cit.* 354, tab. 12; *Bot. Mag.* n. s. xiii. 1840, t. 3731; *Bot. Reg.* xxvi. 1840, t. 43; *Paxton, Bot. Mag.* v. 1837, t. 123; *C. Koch, loc. cit.* 253; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 23, n. 100; *Honzō Dsufu*, vol. vi. fol. 10 verso (?) et 11 verso.

Hab. in *Japoniæ* (*Siebold*, teste *C. Koch*) principali insula: prov. Shinano legit Tschonoski! flor. (*Maximowicz*, iter secundum, 1864, ex herb. horti bot. Petrop. in herb. Kew.).

γ. ? HUMILE, *T. Itō.* Planta humilis multo minor quam cetera, foliis triternatis, *rigidis*, glabris, floribus albidis.—*Honzō Dsufu*, vol. vi. fol. 11, fig. dextra (bona).

Herb. J. Gay! sub "*E. macranthum*, Morr. et Decne. Jardin des plantes" in herb. Kew.

Ab *E. pumilo* (specc. ex hort. Edward Leeds in herb. Kew.! et

Baker, in Gard. Chron., *loc. cit.* 683) mihi differe videtur, quæ est tantum planta juvenalis *E. macranthi*, var. *β. violacei.* Fortasse tantum parva forma *α. typici.*

E. Musschianum, *Morr. et Decne. loc. cit.* 353; *Graham in Bot. Mag.* t. 3745; *Baker! loc. cit.* 683; *C. Koch, loc. cit.* 253; *Miq. Prol.* 2.—Japonia (*Itō Keiske*, fide *C. Koch, l. c.*). Herb. ex horti bot. Petrop. flor.! in herb. Kew. Specc. sicc. in hort. Kew. culta in herb. Kew. fl. albis.

Ab *E. macrantho* distincta est bene hæc planta fere, hujus calcaribus petalis brevioribus, longioribus illius.

Cl. Maximowicz mihi notam sequentem scripsit:—

E. Musschianum.—Hujus duas formas habeo; aliam albis floribus (veterem) quam in Europa sola coli scio, aliam violaceam a me in hortis Nagasaki lectam. Ambæ hybridæ videntur; violacea inter *E. macranthum fl. violaceum* et *E. diphyllum* foliis integris obtusis, calcaribus brevissimis; alba origine et formis foliorum incerta, magnitudine florum, et longitudine calcarium valde variabilis.

E. concinnum, *Vatke, in Regel, Gartenflora*, vol. xxi. 1872, 165, tab. 726; *Baker! in Gard. Chron. loc. cit.* 683.

Hæc planta, quam descriptione iconibusque in 'Gartenflora' (*l. c.*) et typico Bakeriano specimine (in Gard. Chron. *l. c.*) in herb. Kew. tantum scio, proxima *E. Musschiano* videtur. Præterea immaturum Bakerianum specimen videtur et ejus specimini *E. Musschiani* est simillimum, sed caulis ad summitatem habet 2 folia opposita, trifoliata, pedunculum pauciflorum, sepalos pallidos, petalos purpureos vel rubro-purpureos.

E. rubrum, *Morr. in Belg. Hort.* 1854, 33, tab. 6. figg. 1–6; *Regel, Gartenflora*, 1857, 21, et 1862, 311, tab. 373. figg. 4–7; *Index sem. hort. Petrop.* 1856, 33; *Baker! loc. cit.* 620.—E. alpinum, *L.*, var. rubrum, *Hook. Bot. Mag.* 1867, t. 5671; *Morren, in Belg. Hort.* vol. xviii. 1868, 199, tab. xiv. n. 2.—E. alpinum, *Thunb. Fl. Jap.* 62.—E. macranthum, *Morr. et Decne.* var. *β.* Thunbergianum, *Miq. Prol.* 2 (in part); *Franch. et Sav. Enum.* i. 23.—Spec. ex hort. bot. Petrop. flor. in herb. Kew. vidi.

Hæc planta florum forma similior *E. alpino*, L., quam *E. macrantho*, Morr. et Decne., esse mihi videtur, propterea quod illius speciei varietati in Bot. Mag. t. 5671 jam relata est. Quam igitur propius *E. alpino* locandam esse non incredibile videtur. Neque tamen hujus plantæ sub distincto capite constituendæ necessitas scientia nostra imperfecta in præsentia declarari potest.

Nam eam cultam tantum scimus sed sua sponte crescentem non invenimus. Ulteriore sane studio opus est. Opinio, qua hæc planta hybridus inter *E. alpinum* et *E. macranthum* existimatur, a Morreno proposita et a Bakero secuta, manifeste non est accipienda, si de eo quod Thunbergii specimen typicum est in herb. Mertensii, sub nom. *E. alpinum*, eadem cum cl. Maximowicz credamus qui mihi minute scripsit sic:—

E. rubrum.—Hæc planta est *E. alpinum*, Thunb. Fl. Jap. 62, ut cerno specimine in Japonia a Thunberg ipso lecto et in herb. Mertensii locato quod in hortis botanicis Petropolis est. Mirum est Upsali herb. Thunbergii plantam deesse. Mertensii specimen est florescens; authenticum etiam de toto, propterea quod a Thunbergio ipso denominatum est atque glutinatum est in iisdem Batavis papyris ac cetera ejus collectionis specimina Upsali. Sed dimidia tantum est charta, reliquo tortuose abscisso tamquam si alterum specimen in eadem charta esset. Valde autem incredibile Thunbergii ætate Yedo esse hybridum inter *E. alpinum* et *E. macranthum*, quem Bakerus *E. rubrum* esse dicit! Quam opinionem Bakerus a Morreno (Belgique horticole, 1854, p. 33, cum tabula) accepit, sed Morrenus *E. rubrum* ex aliorum sententia esse introductum a Sieboldio, aliorum esse hybridum inter *E. macranthum* et *E. alpinum* dixit et quæsitionem non decretam linquit. Manifestum est validius esse testimonium pro Japonica origione: evanuit opinio quæ eam plantam hybridam nominat.

2. E. DIPHYLLUM, *Lodd. Bot. Cab.* xix. 1832, n. 1858; *Graham, in Bot. Mag.* ix. 1835, t. 3448; *Baker, loc. cit.* 683.—E. japonicum, *Sieb. herb. in Miq. Prol.* 3.—Aceranthus diphyllus, *Morr. et Decne. loc. cit.* 349, tab. 14; *C. Koch, loc. cit.* 253; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 24, n. 103.—Baikwa Ikari, *Sōmoku Dsusetsu*, ii. fol. 47, n. 46; *Honzō Dsufu*, vol. vi. fol. 12 recto.

Hab. in *Japoniæ* (*Itō Keiske, Siebold*, teste *Miquel*; herb. Lugd.-Bat.! in herb. Kew. flor.) insula Kiusiu: prov. Higo, in urbe Kumamoto et in monte Kipon-san (*Maximowicz*! iter secundum, 1863, ex herb. horti bot. Petrop. in herb. Kew., nec non teste *Honzō Dsufu, l. c.*). Herb. *J. Gay*! flor. in herb. Kew.

Japonice: Baikwa Ikariso, i. e. *Epimedium pruniflorum* (*P. Mume*, Sieb. et Zucc.).

3. E. SINENSE, *Siebold herb. in Miq. Prol.* 2; *Hance, Journ. Bot.* 1882, 2.—E. Ikariso, *Regel, Index sem. hort. Petrop.* 1868, 89; *Franch. et Sav. Enum.* i. 24, n. 101.—E. sagittatum, *Maxim.*

Mél. Biol. 1876, ix. 713; *Baker, loc. cit.* 683.—Aceranthus sagittatus, *Sieb. et Zucc. Fl. Jap., Fam. Nat.* n. 296; *C. Koch, loc. cit.* 253; *Miq. Prol.* 2; *Franch. et Sav. Enum.* i. 24, n. 102.—A. triphyllus *et* macrophyllus, *C. Koch, loc. cit.*; *Sōmoku Dsusetsu*, ii. fol. 45, n. 44; *Honzō Dsufu*, vol. vi. fol. 10 recto.

Hab. in *Japonia* (herb. Lugd.-Bat.! in herb. Kew. pl. steril.). In Japonensium hortos cultos e China introducta, etiam in prov. Kōshiu sponte crescere dicitur (teste Sōmoku Dsusetsu, *l. c.*).

China: Kiu Kiang (*Dre. Shearer*! 1873); juxta urbem I-chang, prov. Hu-peh, legit *T. Watters* (ex *Hance*).

Japonice: Hozakino Ikarisō, i. e. *Epimedium paniculatum*.

E specimine Japonico, loco spec. non indicato (flor.!), quod ante oculos mihi est, sequentes characteres notavi:—

Foliis setoso-ciliatis, subtus nervis prominentibus radicalibus ternatis; caule erecto simplici, foliis oppositis cum folio juvenali medio inter vetera exorto, foliis ternatis longo petiolatis, petiolis glabris ad segmenta fuscis, leviter striato-angulatis v. canaliculatis; foliolis obovatis v. ellipticis, acuminatis v. acutis, basi foliorum inæqualiter sagittatis v. sagittato-hastatis, apicibus lobium acutis v. acuminatis rarius submucronato-obtusis; racemo composito gracili multiflori glabro leviter striato, petiolis gracilissimis 1–3-floris ad basin bracteatis, bracteis linearibus; sepalis ovato-ellipticis, obtusis; ovario subinæqualiter elliptico, stylo longiore.

Diversum videtur a proxime affini *E. pubescente*, Maxim., quod non vidi, sed cognovi descriptione iconibusque cl. Maximowiczii, foliis hastatis subtus non crebre pilosis sed glabris, flore majore, sepalis non acuminatis sed obtusis, et pedicellis glabris non glanduloso-pilosis.

E cl. Bakeri sententia (Gard. Chron. xiii. 1880, 683), *E. Ikariso*, Regel, Index seminum hort. Petrop. 1868, 89, est hybridus inter *E. alpinum* et *E. Musschianum*, sed e Regeli descriptione, foliola e basi sagittato-cordata v. inæqualiter sagittata oblongo-elliptica, a qua mihi, ut cl. Maximowicz in Mélanges Biologiques, vol. xi. 713, demonstravit, synonymus *E. sinensi* manifeste videtur.

E. longifolium, Decaisne, in Revue Horticole, 1854, 285, mihi ignotum.

DIPHYLLEIA, *Michx.*

D. GRAYI, *Fr. Schmidt, Fl. Sachal.* 109; *Miq. Prol.* 364; *Franch. et Sav. Enum.* i. 25, n. 104.—D. cymosa, *A. Gray, Bot.*

Jap. 380 (*non Michx.*).—Sanka Yō, *Honzō Dsufu*, vol. xxiii. fol. 5 verso; *Sōmoku Dsusetsu*, vii. fol. 25; *Itō Keiske, Nihon Sanbutsushi, pt. prov. Ōmi*, ii. fol. 22, cum icone.

Hab. in *Japoniæ* (*C. Wright*! frf.) principali insula: monte Togakushi (*Itō Yudsuru*!); Tengu-Iwa in monte Ibuki, prov. Ōmi; in pagis Hagiwara-Mura et Naka-Mura, Kiso; prov. Etsigo; in monte Hakusan, prov. Kaga; in montanis Nikkō, prov. Shimodsuke (teste *Itō Keiske, l. c.*). In insula Yezo: ad promontorium Soya (*Small*); prope Hakodate (*Maximowicz*).

Tum in *Sachalin* (*Angustinowicz*! flor.).

Japonice: San-ka-yō.

Ab affini *D. cymosa*, Michx., fructibus majoribus polyspermis, seminibus pyriformibus rectis, cyma pubescente facile distinguitur.

D. cymosa, Michx., hab. in America boreali: in locis humidis sylvarum region. med. mont. Smoky, Tennessee (*Rugel*! flor. Aprili et fructif. Aug. 1884, spp. 2); in montibus altioribus Virginiæ et Carolinæ septentrionalis (*A. Gray* et *J. Carey*! Julio 1841, spp. 3, frf.).

Podophyllum, *L.*

1. P. japonicum, *T. Itō in Maxim. Mél. Biol.* t. xii. 1886, 417.

Hab. in *Japoniæ* principali insula: monte Togakushi (*Itō Yudsuru*!).

Japonice: Togakushi Sō, *i. e.* Planta e Togakushi (*mihi*).

Hæc planta, cujus folium cum florum figuris ad Maximowicz, notissimum Academicum Petropolis, specimen misi, ab illo in diagnose plantarum asiaticarum nuper descripta est. Hæc tamen est manifeste nova species, cui ceteræ *Podophylli* species de toto dissimiles sunt ternatis foliis. Mihi autem a speciminum paucitate positio generis adhuc dubia videtur. Fructus tamen nunquam vidi, sed cl. Tanaka vidisse baccas nigro-cæruleas meminisse mihi dixit.

Species non satis nota.

2. P. peltatum, *L. ex Maxim. loc. cit.* 418; *Honzō Dsufu*, vol. xxiii. fol. 7 recto?

"Nippon in alpibus" (*Tanaka*, japonice Sankayō).

"Summitas speciminis florentis missa dubia est propterea quod stamina tantum 6. Cetera: foliorum indoles, floris inserto,

stamina, stigma fungosum—omnino identica; pubes tamen paginæ folii inferioris ad basin nervorum parcissima." (*Maximowicz.*)

Cl. Maximowicz adumbrationem hujus plantæ, cui sunt duo folia, sua manu ex unico specimine in Japonia lecto recte descriptam, ad me benigne misit. Quæ adumbratio mihi non diversa a *P. peltato* videtur. Eandem sententiam cl. Maximowicz in epistola ad me scripta extulit, sed dubitat utrum specimen culta planta Americana, necne sit. Nec *P. peltatum* usquam in Japonia inventum esse audivi, nec de eo quicquam dicere possum. Attamen plantam in Honzō Dsufu (*loc. cit.*), delineatam pro affinitatem *Diphylleiæ*, huic esse proxime similem videri animadverto, quæ, si esse eandem sumamus, indigena Japoniæ existimanda est, quamquam auctor Honzō Dsufu locum speciale non memorat.

Achlys, *DC.*

A. triphylla, *DC. Syst.* ii. 35; *Prodr.* i. 112; *G. Don, Syst.* i. 1831, 120; *Hook. Fl. Bor.-Am.* i. 1833, 30, t. 129; *Torr. et Gray, Fl. N. Am.* i. 53; *Torr. Bot. U. S. Explor. Exped.* 219; *Newberry, Pac. R. Rep.* vi. 66; *Cooper, id.* xii. 56; *Boland. Cat.* 4; *Gray, Proc. Am. Acad.* viii. 376; *Watson, Bibl. Index N. Am. Bot.* 33; *Brewer et Watson, Bot. Calif.* i. 16.—Leontice triphylla, *Smith, Rees's Cycl.* n. 5; *Schult. Syst.* vii. 21; *Dietr. Syn.* ii. 1073.

α. typica.

Hab. in *America* boreali occ. (*Douglas*! 1829 flor., *Scoulter*! flor.): California!; Oregon (*W. Lobb*! n. 313 flor., *Elihu Hall*! 1871, n. 21, frf.); fl. Lower Frazer, 49° lat. bor. (*Dre. Lyell*! 1859 in schedula sub 'in silvis, fin. April. flor.'); New Georgia (*Menzies*! herb. Brownianum in herb. Kew. flor.); Columbia (*Dre. Gaiden*! April. 1834, n. 32, in schedula sub 'shallow wood,' flor. et frf.); monte Tacoma, in territ. Washington (*J. Bryce*! comm. *A. Gray* in herb. Kew.); in insula Vancouver (*Dre. Lyell*! 1858 flor., *Dre. C. B. Wood*! 1862, frf.).

β. japonica, *T. Itō.*—A. japonica, *Maxim.*! *Mél. Biol.* t. vi. 260.—Planta minor quam in typica; foliola minora, terminalis apicis leviter triloba cetera integerrima.

Hab. in *Japoniæ* principali insula: in silvis subalpinis prov. Nambu legit Tschonoski! 1855 subdeflor. ex herb. Maximowicz, iter secundum.

Japonice: Nambu Sō, *i. e.* planta e Nambu (*mihi*).

A. triphylla foliis trifoliatis valde variabilia est, aut parvis aut magnis et bene expansis, aut sinuato-dentatis, aut remote lobatis, aut spicis, aut densis aut interruptis. Planta ex insula Vancouver, a Dre. C. B. Wood lecta, illi Japonicæ parvitate est similis; similiores etiam e Nova Georgia et California lectæ sunt, ita ut, quod ad Californiæ plantas fere nequeamus discernere quo Americanæ et Japonicæ inter se distincta sint.

Cl. Maximowicz, postquam descriptionem superiorem vidit, mihi epistolam sequentem scripsit:—

Achlys japonica: Quam eam descripsi, specimina tantum, quibus eam conferrem, ex insula Vancouver a Dre. Lyell lecta habui. Neque alia adhuc recepta esse video. Itaque nihil quicquam novum de planta dicere possum. Fortasse te recta dixisse potest. Fructus tamen, quoad scio, adhuc incognitus est et forsitan distinctiones exhibet.

Cl. Prof. Oliver, qui meam opinionem de hac planta valde credibilem esse dixit, non modo auxilium benignum de hujus plantæ determinatione sed etiam multa alia officia debeo.

Postscriptum.—Postquam meum "Berberidaceæ Japonicæ" paravi, monographia "Sur les espèces du genre *Epimedium*" cl. Franchet auctore in 'Bulletin de la Société Botanique de France,' tome viii. n. 2, Mai 1886, edita est, quæ mihi persuasit, ut observationes paucas addam. Quantum ad *Epimedium violaceum*, Morr. et Decne., attinet, cl. Franchet in unam et eandem conclusionem mecum pervenit. Namque ille quoque hanc plantam in varietatem tantum *E. macranthi*, Morr. et Decne., esse reducendam statuit. Quamquam antea plantam sub nomine *E. macranthum*, Morr. et Decne., var. *β. violaceum*, T. Ito, reducere proposueram, libenter cl. Franchet auctoritati jure prioritatis jubente concedam.

E. rubrum, Morr., cl. Franchet (*loc. cit.* 107), sententiam ab Hooker (Bot. Mag. 1867) jam propositam habet, qui plantam esse varietatem *E. alpini*, L., viz. *E. alpinum*, L., var. *rubrum*, Hook., existimavit. Nihil tamen de hac planta dicere potero, donec evidentiam de origine occasionis habuerimus.

Cl. Maximowicz ad me nuper scripsit quod specimen (sterile) a Miquel dictum Thunbergii *E. alpinum*, quod Miquel *E. macranthum*, Morr. et Decne., var. *β. Thunbergianum*, Miq. (Prol. 2), adduxit, re vera esse *E. rubrum*, Morr. Ceterum Miquel flores

et Thunbergii *E. alpini* et *E. macranthi* unos et eosdem descripsit, quamobrem Miquelianum specimen (non Thunbergianum) *E. alpini* (ut nominatur) esse re vera *E. macranthi*, Morr. et Decne., est sumendum.

EXPLICATIO TABULÆ XXI.

Achlys triphylla, DC., var. *japonica*, T. Itō.

Fig. 1. Specimen subdeflorens, mag. nat.
2. Spicæ pars cum carpellis immaturis, mag. auct.
3. Flos subdefloratus cum 3 staminibus persistentibus, mag. auct.
4. Stamen, mag. auct.

On a new Instance of Apospory in *Polystichum angulare*, var. *pulcherrimum*, Wills. By CHARLES T. DRUERY, F.L.S.

[Read 16th December, 1886.]

IN December 1884, and previously, I brought before the notice of this Society the results of certain investigations into a mode of reproduction in *Athyrium Filix-fœmina*, var. *clarissima*, hitherto unobserved, and to which Prof. F. O. Bower gave the name of apospory, the spore being eliminated from the life-cycle of the fern, the prothalli springing direct from the stalks of aborted sporangia. This discovery in the variety of *Athyrium* in question was followed by Mr. G. B. Wollaston's discovery of a kindred phenomenon in an abnormal form of *Polystichum angulare*, var. *pulcherrimum*, Padley, in which plant, however, it is developed in an altogether different manner, the prothalli being produced in this case by simple extension and dilatation of the growing tips of the pinnules, so that not only the spore, but the entire sorus is excluded from the normal cycle of existence.

The particular specimen of *Polystichum angulare* in which this phenomenon was remarked was found many years previously, growing wild in North Devon, since which time it had constantly produced its characteristic expansions of the pinnule-tips, which, however, were regarded at first as a minute form of that cresting common to so many abnormal forms of Ferns, and consequently their true character as prothalli proper remained for a long time unsuspected.

One of the peculiar characteristics of this Fern is a marked elongation of all the lower divisions of the pinnæ, *i. e.* pinnules, the upper ones retaining nearly or quite their normal outline ; and

as it was mainly upon these attenuated divisions that the prothalli were formed, the points running out into threads at the ends of which the prothalli appeared, it struck me that as these attenuated pinnæ were not confined to this individual *Polystichum*, others presenting the same peculiarity might develop the rest of the phenomena under suitable treatment. I consequently applied to Colonel Jones, of Clifton, for whose aid throughout these investigations I cannot too strongly express my thanks, and was duly furnished with a young plant of the form known as *P. angulare* var. *pulcherrimum*, Wills, found by the late Dr. Wills in Dorsetshire some years ago. This form, which, it will be noted, was found some seventy or eighty miles distant from Mr. Padley's station, moreover differs markedly in general character, so that no doubt can reasonably be entertained of its distinct origin; the characteristic prothalloid extensions had also never been remarked upon it.

On receipt of the plant early in the present year (1886), I at once placed it in a close *Todea* frame, with the result that as soon as the fronds attained the length of some 6 inches or so, I was delighted to find the tips of the pinnules running out and dilating into prothalli in profusion, until the pinnæ were absolutely fringed with them, precisely in the same manner as in Padley's form. Later in the season, however, the close treatment disagreed with the plant, and on removal from the frame to a cool fernery, the prothalli dried up and perished; fortunately, however, not before Prof. Bower was able to inspect the plant and obtain material for further investigation. It seems highly probable from the rapid disappearance of the prothalli, in this case under nearly normal conditions, that they would not be developed under ordinary circumstances to an extent likely to attract observation.

So far the phenomena observed had been precisely similar to those noticed in Padley's form; but upon further close examination of the fronds I was struck by the existence of several hydraform bodies, clearly visible to the naked eye, which appeared to be attached to the upper surface of the pinnules well within the margin, and in this respect, as well as in their shape, entirely different from the prothalliform point-extensions.

On examining several of these under the microscope, I found their distinct character emphasized by the fact that they were in

every case produced at the ends of excurrent veinlets protruding from the surface of the pinnules, well within the margin, and thickening at the distance of about $\frac{1}{20}$ of an inch into a pear-shaped body, from which radiated in all directions numerous root-like hairs. The brown and shrivelled condition of these bodies led me to the belief that it was essential to their full development, whatever that might be, that they should at an early stage find some suitable nidus whence the hairs, assuming them to be root-hairs, might obtain the needful elements for growth. After a long search I was fortunate enough to find one of these bodies in a young state, the pear-shaped head only being formed, and the hairs just beginning to develop. I at once removed the plant into a large shallow pan and pegged down the frond so that the excrescence was brought into very close proximity to the soil.

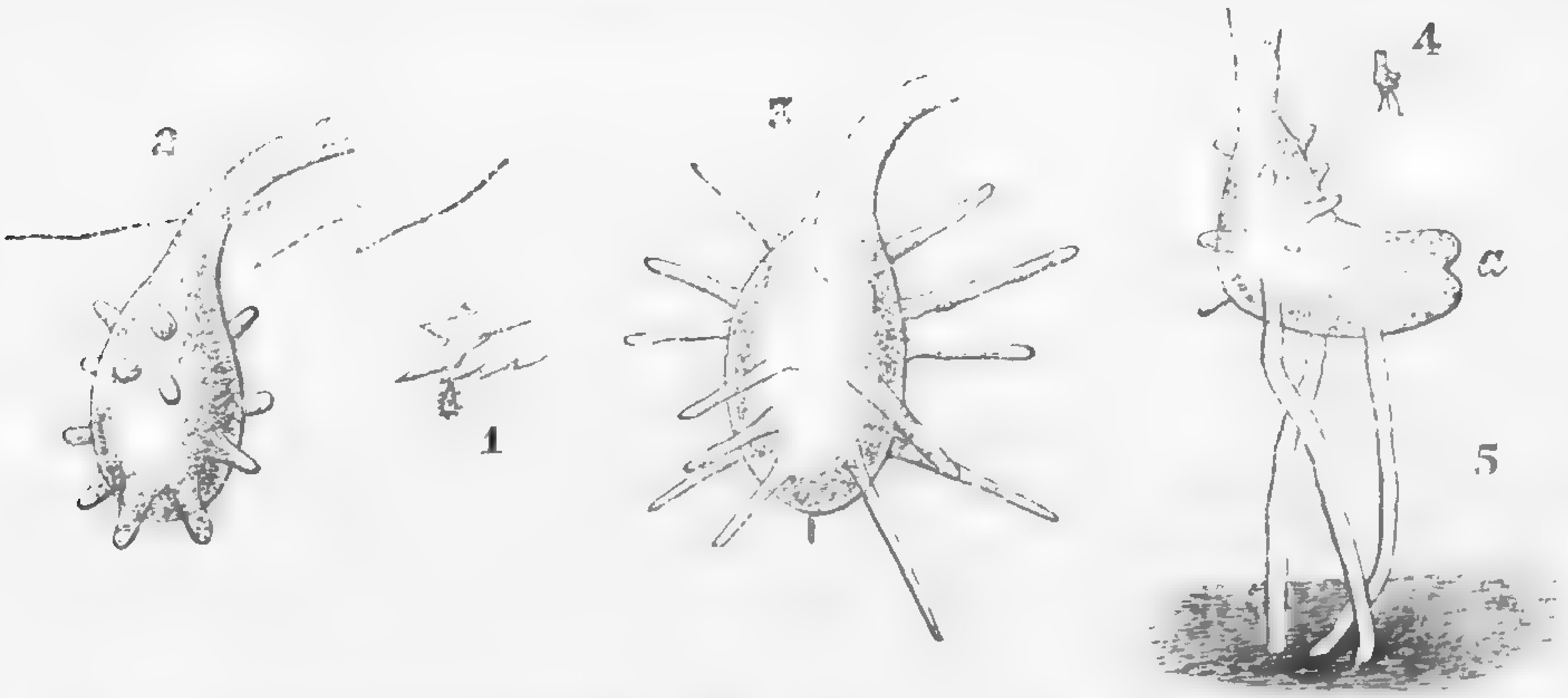


Fig. 1. Hydraform excrescence, nat. size, in *Polystichum angulare*, var. *pulcherrimum*, Wills.—Fig. 2. The same, magnified.—Fig. 3. Further development, showing radiating filaments.—Fig. 4. When assuming prothalloid form, nat. size. —Fig. 5. The same enlarged, showing incipient sinus (*a*) and developed roots.

This was on September 5th, when it presented the appearance shown in figs. 1 & 2. On September 10th I observed that the root-hairs had much developed, radiating stiffly in all directions without any apparent bias towards the soil (fig. 3). On October 2nd, after a temporary absence, I found that some water had been spilt over the object under examination, partly burying it in soil; on removing which I found that it had sent several long threads from the lower end into the soil, and that the upper ones had either aborted or been broken off, as nothing but short projections remained. At this date the shape had materially altered in the prothallus direction, having flattened out laterally in the same plane as the soil, and formed an incipient but unmistakable

sinus (figs. 4 & 5). Since that date growth has continued, though slowly, with the result that it is now an undoubted prothallus, though much thicker in substance than those produced by extension of the pinnule-tips.

From these observations it will be seen that the formation of the prothallus in this case is preceded by a very different series of phenomena from those already recorded. In the one case the prothalli are simple extensions of the cellular substance of the tips of the pinnules, commencing at points quite beyond the venation, and, so far as I have observed, produce no root-hairs unless brought into contact with the soil. In the other case, however, the prothallus is a direct outgrowth of the tip of a veinlet protruded through the upper surface of the pinnule, and at once produces root-hairs in abundance long before it assumes any other characteristic of a prothallus; and, finally, the resulting prothallus is much thicker in substance. Whether archegonia or antheridia are present upon the solitary specimen I have had under examination, I cannot say, as the disturbance necessary for microscopic scrutiny would probably have been more destructive than profitable.

These excrescences, it will be observed, bear several striking resemblances to the pear-shaped pseudobulbils first observed in *Athyrium Filix-fœmina*, var. *clarissima*. Their size, shape, and the production at an early stage of radiating root-hairs are peculiarly akin, as also the dilatation of the free end of the body into a prothallus; on the other hand, they are differentiated by their isolation and independent position with regard to the sorus.

I will conclude my remarks by pointing out that in all three cases of apospory now observed there appears correlated with the phenomenon a marked elongation of the ultimate divisions of the frond. *Athyrium Filix-fœmina*, var. *clarissima*, is very remarkable for this character; and on the two species of *Polystichum* the lower pinnæ are so characterized, while the upper pinnæ, which nearly approach the normal form, are comparatively barren of prothalli. I mention this as it may form a clue to the discovery of the phenomenon in other Ferns which, like the one under special notice, may only require close treatment to yield similar results. I am therefore sanguine that other workers, in not only British, but exotic Ferns, may thus light upon new instances of the phenomenon in question, and so increase the opportunities of completely studying it.

Further Contributions to the Flora of Madagascar.

By J. G. Baker, F.R.S., F.L.S.

[Read 18th November, 1886.]

Since I last reported to the Linnean Society on the Flora of Madagascar, in the Session of 1884–85, two large boxes of plants have been received from our indefatigable correspondent, the Rev. R. Baron, F.L.S. One of these, owing to the unsettled state of political affairs in the island, did not reach us for more than a year after the letter announcing it came to hand, so that we had quite given it up for lost. These two boxes carry up his collecting-numbers to nearly 5000. The present paper contains descriptions of the principal new genera and species included in these boxes of which the specimens were sufficiently complete. There appear to be seven new genera—one in Menispermaceæ, one in Geraniaceæ, two in Melastomaceæ, one in Rubiaceæ, and two in Compositæ. The species are distributed through the primary divisions as follows, viz.:—Thalamifloræ 51, Calycifloræ 48, Gamopetalæ 93, Incompletæ 31, Monocotyledons 27, Vascular Cryptogamia 5.

As before, the great bulk of the new species belong to the large, well-known, widely-spread tropical genera, such as *Garcinia*, *Hibiscus*, *Begonia*, *Vernonia*, *Vitis*, *Ficus*, *Piper*, and *Cyperus*. Of characteristically Cape types we have *Pelargonium*, *Stoebe*, *Belmontia*, and *Cineraria* added to the flora of Madagascar, a second species of *Crassula*, several fleshy-leaved Kleinioid *Senecios*, and a curious dwarf *Aloe*, allied to the Cape *Aloe aristata* of Haworth. Of familiar European genera we have *Celtis* and *Deyeuxia* added and new species of *Nasturtium* and *Ajuga*. Of the endemic Madagascar genera we get new species of *Asteropeia*, *Rhodolæna*, *Dichætanthera*, *Veprecella*, *Gravesia*, *Kitchingia*, *Dicoryphe*, *Oncostemum*, *Mascarenhaisia*, and *Dypsis*. There is nothing materially fresh affecting the relations of Madagascar to Tropical Africa, Mauritius, and Bourbon. The feeble affinity of the Madagascar to the Indian and Malayan flora is strengthened by the discovery of the genus *Cyclea* and of new species of *Alyxia*, *Didymocarpus*, and *Strobilanthes*. Of types of certain or possible economic interest we have species of *Dalbergia*, *Macaranga*, and *Strychnos*, two species of *Commiphora* (*Balsamodendron*) and four of *Garcinia*. A curious Euphorbiaceous

plant seems to belong to the American genus *Pedilanthus*, but the material is incomplete.

For convenience of reference I give a list of the recent papers which have appeared in English periodicals, in which new or imperfectly known plants from Madagascar have been described.

	Genera.	Species.
1876. Ferns collected by Mr. and Mrs. William Pool. Baker, Journ. Linn. Soc. xv. p. 411	...	26
1877. Ferns collected by Miss Helen Gilpin. Baker, Journ. Linn. Soc. xvi. p. 197	...	21
1879. Flowering Plants collected by L. Kitching. Baker, Journ. Linn. Soc. xviii. p. 264	2	33
1880. Ferns collected by L. Kitching. Baker, Journ. Bot. 1880, p. 326	...	13
1880–85. Endemic Genera figured in Icones Plantarum. *Micronychia*, Oliver, t. 1337; *Epallage*, DC. t. 1394; *Rhaphispermum*, Benth. t. 1402; *Cardiochlamys*, Oliv. t. 1403; *Bembicia*, Oliv. t. 1404; *Xerochlamys*, Baker, t. 1413; new ...	3	3
1882. New Plants collected by Messrs. Baron and Parker. Baker, Journ. Bot. pp. 17, 45, 67, 109, 137, 189, 218, 243, 266; reprint paged differently	2	108
New Plants collected by Messrs. Baron and Parker. Baker (with synopsis of *Cyperus* by C. B. Clarke), Journ. Linn. Soc. xx. pp. 87–304	5	392
1883. New Monocotyledons collected by Deans Cowan. Ridley, Journ. Linn. Soc. xx. p. 329	1	10
1884. On *Hyalocalyx*, a new genus of Turneraceæ. Rolfe, Journ. Linn. Soc. xxi. p. 256, t. 10	1	1
New Plants collected by Baron. Baker, Journ. Linn. Soc. xxi. pp. 317, 407	8	190
Cyperaceæ novæ. Ridley, Journ. Bot. p. 13	...	3
Ferns collected by Humblot. Baker, Journ. Bot. p. 139	...	15
1885. Complete list of all the known Orchids of Madagascar, with descriptions of new and little-known species. Ridley, Journ. Linn. Soc. xxi. p. 456		74
New Orchids collected by Fox and Baron. Ridley, Journ. Linn. Soc. xxii. p. 116	...	19
1886. The present paper	7	255
	29	1163

THALAMIFLORÆ.

POPOWIA MICRANTHA, n. sp.

Arborea, glabra, ramulis gracilibus purpurascentibus copiose lenticellatis, foliis oblongis petiolatis, floribus axillaribus solitariis longe pedicellatis, sepalis parvis orbicularibus, petalis 6, exterioribus orbicularibus, interioribus oblongis, staminibus carpellis æquilongis, carpellis 8–9 ovoideis brunneo-sericeis.

A tree, glabrous in all its parts except the carpels, with copious, very slender branchlets. Leaves alternate, distinctly petioled, $1\frac{1}{2}$–2 in. long, moderately firm in texture, green on the upper surface, glaucous beneath, with fine inconspicuous veins. Flowers copious, solitary, axillary, on very slender spreading pedicels, sometimes an inch long. Calyx persistent, $\frac{1}{8}$ in. in diam. Petals deciduous, outer $\frac{1}{8}$ in. long and broad, inner about half as broad. Carpels very small in the flowering stage, densely silky. —*Baron* 4773! *Popowia* is united to *Unona* by Baillon. There are several Madagascar species already known.

CYCLEA MADAGASCARIENSIS, n. sp.

Sarmentosa, glaberrima, caulibus gracilibus angulatis, foliis ovatis acuminatis subcoriaceis nitidis venulis ad faciem inferiorem omnibus exsculptis, petiolo supra basin insertis, floribus masculis in paniculas parcas axillares dispositis, pedicellis flore longioribus, sepalis 6 oblongis basi solum coalitis, petalis in corollam globosam coalitis ore crenato, columna staminea apice peltata corolla æquilonga.

A shrub, with slender angled twining stems. Leaves glossy, firm in texture, 2–3 in. long, green on both sides, with the petiole inserted a short distance above the truncate or slightly emarginate base, with 5 veins radiating from its insertion upwards and 2 horizontally, all the veins and veinlets raised on the under surface. Flowers in narrow peduncled axillary panicles, as long as or shorter than the leaves; pedicels articulated at the apex, $\frac{1}{2}$–1 line long. Bud globose, blackish, not more than half a line in diameter. Corolla shorter than the calyx.—*Baron* 3766! Adds this well-known Indian and Malayan genus to the Madagascar flora.

GAMOPODA, genus novum Menispermacearum.

Dioicum. Flores masculi. Calyx polyphyllus, sepalis 6 oblanceolatis obtusis imbricatis extus dense pilosis. Petala 6 oblonga glabra concava, calyce 2–3plo breviora. Stamina 3–4, filamentis deorsum connatis apice liberis, antheris terminalibus adnatis tetragonis bilocularibus. Flores fœminei ignoti.

G. DENSIFLORA, *Baker*.

Species sola.

An erect shrub, with slender terete woody branchlets, clothed with dense short persistent brown pubescence. Leaves alternate, shortly petioled, ovate-lanceolate, entire, acute, 3–5 in. long, 1–2 in. broad below the middle, rigidly coriaceous, green

and glabrous above, clothed with deciduous brown hairs on a glaucous groundwork beneath, all the main veins and anastomosing veinlets raised. Flowers many, arranged in dense sessile or shortly peduncled congested cymes in the axils of the leaves. Calyx $\frac{1}{12}$ in. long, densely clothed with brown-drab hairs on the outside. Petals brownish, at most $\frac{1}{24}$ in. long. Stamens about as long as the petals, the square anthers entirely adnate to the tip of the filaments.—*Baron* 2927! Allied to *Triclisia*, Benth., from which it differs by its adnate anthers and flower-wrapper divided out into a distinct calyx and corolla.

NASTURTIUM MILLEFOLIUM, n. sp.

Annuum, caulibus dense cæspitosis brevibus cæspitosis humifusis, foliis petiolatis oblongis decompositis segmentis minutis crassis oblongis, floribus axillaribus solitariis breviter pedicellatis, sepalis parvis oblongis, petalis obovatis unguiculatis albis calyce duplo longioribus, staminibus calyci æquilongis, fructu oblongo-lanceolato stylo brevi apiculato.

An annual, with a fusiform root, with many short stems a few inches long radiating from its crown. Leaves $\frac{1}{2}$–$\frac{3}{4}$ in. long, decompound like those of *Sisymbrium Sophia*, with very small ultimate segments. Flowers solitary from the axils of the leaves all down the stem; pedicels short, erecto-patent. Calyx $\frac{1}{16}$ in. long. Petals $\frac{1}{8}$ in. long. Pod $\frac{1}{6}$–$\frac{1}{4}$ in. long, tipped with a short persistent style.—*Baron* 4428! Antananarivo, *Hildebrandt* 4056, ex parte.

APHLOIA MINIMA, n. sp.

Fruticosa, ramosissima, glabra, foliis parvis oblongis breviter petiolatis supra basin argute serratis, floribus solitariis terminalibus breviter pedicellatis, sepalis orbicularibus, staminibus demum calyci æquilongis, ovario ampullæformi stigmate peltato.

A very much branched small shrub, glabrous in all its parts. Leaves alternate, $\frac{1}{3}$–$\frac{1}{2}$ in. long, moderately firm in texture, green and glabrous on both surfaces, obtuse, cuneate and entire at the base. Flowers solitary, terminal; pedicels $\frac{1}{8}$–$\frac{1}{6}$ in. long. Bud $\frac{1}{8}$ in. in diam.; sepals 5, orbicular, the two outer thicker and darker in colour than the three inner. Stamens very numerous. Ovary glabrous; stigma large, capitate.—*Baron* 4514!

PITTOSPORUM PACHYPHYLLUM, n. sp.

Fruticosum, glabrum, ramulis validis, foliis breviter petiolatis sparsis vel verticillatis oblanceolatis obtusis crassissimis rigidissimis e medio ad basin angustatis, umbellis paucifloris sessilibus terminalibus, pedicellis

fructui æquilongis, gynophoro nullo, valvis 2 percrassis rigidissimis divaricatis, ovulis ad placentam singulam 8–10, seminibus globosis castaneis.

An erect shrub, glabrous in all its parts. Leaves 2–3 in. long, $\frac{3}{4}$–1 in. broad above the middle, very thick and rigid in texture, green above, drab beneath, the veins fine and immersed; petiole $\frac{1}{4}$–$\frac{1}{3}$ in. long. Umbels sessile at the end of the branchlets, bracteated by full-sized leaves. Flowers not seen. Fruit-pedicels $\frac{1}{3}$–$\frac{1}{2}$ in. long. Valves of the fruit orbicular, under $\frac{1}{2}$ in. long, very thick and rigid, brown on the outside.—*Baron* 1174! 3950!

PITTOSPORUM VERNICOSUM, n. sp.

Fruticosum, ramosissimum, glabrum, foliis irregulariter confertis breviter petiolatis oblongis vel lanceolatis rigidulis utrinque viridibus facie nitidis, umbellis multifloris terminalibus, pedicellis fructu longioribus, fructu globoso glabro brunneo magnitudine pisi valvis 2 patulis, gynophoro brevi, seminibus 2 castaneis nitidis.

An erect shrub, glabrous in all its parts, with irregularly crowded leaves. Leaves 1$\frac{1}{2}$–2 in. long, about $\frac{1}{2}$ in. broad at the middle, acuminate, glossy green above, paler green beneath, with fine immersed veining. Flowers as many as 12, arranged in sessile terminal umbels, with many full-sized leaves at and near the base; fruit-pedicels $\frac{1}{4}$–$\frac{1}{3}$ in. long. Fruit globose, brown, coriaceous, $\frac{1}{6}$ in. long and broad, tipped with a short slender style, the rigid valves finally spreading horizontally. Seeds 2, subglobose, mahogany-brown, arising one each from the base of the two placentas. Flowers not seen.—*Baron* 4942!

POLYGALA LEPTOCAULIS, n. sp.

Annua, caule erecto gracillimo pubescente virgato simplici vel furcato, foliis subsessilibus glabris linearibus vel lanceolatis, racemo terminali elongato laxissimo, pedicellis brevibus inferioribus cernuis, sepalis pallidis viridi venosis, exterioribus parvis oblongis, interioribus magnis obovatis venis sursum anastomosantibus, petalis cæruleis calyce paulo longioribus, carina apice parce cristata, fructu oblongo calyci æquilongo.

An annual, with slender erect finely pubescent stems $\frac{1}{2}$–1$\frac{1}{2}$ ft. long. Leaves extending all the way up the stem to the base of the raceme, laxly disposed, erecto-patent, 1-nerved, 1–1$\frac{1}{2}$ in. long. Raceme 2–5 in. long; pedicels much shorter than the calyx. Outer sepals $\frac{1}{16}$ in. long; inner above $\frac{1}{8}$ in. long, with the 3 green veins connected upwards with cross-veinlets. Upper petals $\frac{1}{6}$ in. long; keel rather longer, with a small crest at the tip of the midrib. Stamens as long as the keel-petal. Capsule oblong, compressed, $\frac{1}{8}$–$\frac{1}{6}$ in. long, emarginate at the apex.—*Baron* 4548! 4590! 4598! Allied to *P. hyssopifolia*, Bojer.

GARCINIA CERNUA, n. sp.

Arborea, glabra, foliis brevissime petiolatis subcoriaceis obovato-oblongis cuspidatis basi deltoideis venis subtilibus inconspicuis, floribus fœmineis ad foliorum axillas brevissime pedicellatis cernuis, sepalis 4 orbicularibus parvis, ovario ampullæformi, stigmate tenui plano peltato lobis 8 orbicularibus patulis.

A tree, glabrous in all its parts. Leaves 4–5 in. long, about 2 in. broad, moderately firm in texture, with 20–25 indistinct veins on each side of the midrib. Flowers solitary, drooping. Calyx $\frac{1}{6}$ in. long; sepals 4, decussate, suborbicular. Petals and stamens not seen. Ovary narrowed gradually into a long neck. Stigma $\frac{1}{6}$ in. in diam., thin, flat, with 8 orbicular spreading lobes.—*Baron* 2653!

GARCINIA ORTHOCLADA, n. sp.

Arborea, glabra, foliis brevissime petiolatis rigide coriaceis oblongis obtusis basi deltoideis venis faciei superioris exsculptis faciei inferioris immersis, floribus fœmineis axillaribus et terminalibus breviter pedicellatis, ovario globoso, stigmate crasso peltato 4-lobato lobis recurvatis.

A tree, glabrous in all its parts, with long straight main branchlets. Leaves very thick and rigid in texture, 2–3 in. long, 1–1½ in. broad, with all the main veins raised on the upper surface in the dried specimens, but not so conspicuous beneath. Flowers produced from the side and tip of the young leafy branchlets. Calyx, sepals, and petals not seen. Ovary $\frac{1}{2}$ in. in diam. after the calyx and corolla fall; stigma $\frac{1}{6}$ in. in diam., with 4 deflexed lobes.—*Baron* 3633!

GARCINIA CAULIFLORA, n. sp.

Arborea, glabra, foliis magnis rigide coriaceis obovato-oblongis breviter petiolatis venulis subtilibus, floribus fœmineis ad ramos crassos vetustos breviter pedicellatis, sepalis oblongis acutis coriaceis, petalis oblongis, ovario globoso ampullæformi, stigmate magno peltato 4-lobato lobis deflexis.

A tree, glabrous in all its parts. Leaves rigid in texture, 6–7 in. long, 2–3 in. broad above the middle, deltoid at the apex, narrowed gradually from the middle to the base, the numerous veins and veinlets but little raised. Flowers produced from thick leafless branches; pedicels $\frac{1}{4}$–$\frac{1}{3}$ in. long. Sepals and petals reflexing, each 4, oblong, $\frac{1}{2}$–$\frac{5}{8}$ in. long, imbricated. Ovary globose, $\frac{1}{3}$ in. in diam. before the petals and sepals fall, narrowed suddenly to a short neck; stigma thin, $\frac{1}{4}$ in. in diam., with 4 orbicular deflexing lobes.—*Baron* 1786!

GARCINIA POLYPHLEBIA, n. sp.

Arborea, glabra, foliis breviter petiolatis oblongis obtusis basi deltoideis rigide coriaceis venis primariis multijugis venulisque pulchre exsculptis, floribus fœmineis terminalibus pedicellatis, ovario subgloboso, stigmate crasso umbilicato lobis 4 rotundatis recurvatis.

A tree, glabrous in all its parts. Leaves 2–3 in. long, 1–1½ in. broad, very rigid in texture, bright green, deltoid at the base, both the nearly spreading main veins and the intermediate veinlets raised on the under surface. Pedicels erecto-patent, ⅓ in. long. Calyx, stamens, and petals not seen. Ovary ⅓ in. long and broad after the petals and sepals fall; stigma ⅙ in. diam., thick, brown, umbilicate in the middle, with 4 recurved semiorbicular lobes.—*Baron* 3064! 3101!

RHODOLÆNA BAKERIANA, *Baill. in Bull. Linn. Soc. Par.* (1886) pp. 566, 571,=R. altivola, *Baker in Journ. Linn. Soc.* xx. p. 95.

Dr. Baillon tells me that the plant which I described in detail (*Baron* 1980! 2173!) is distinct specifically from the original type of Thouars, which has lately been regathered by Humblot (24). Mr. Baron says that *R. Bakeriana* is a tall erect tree, with an edible fruit, and that its native name is *Fotona*. *R. altivola*, Thou., is a climber.

HIBISCUS XIPHOCUSPIS, n. sp.

Herbaceus, caulibus elongatis erectis sursum parce pilosis, foliis petiolatis glabris margine ciliatis inferioribus serratis ovatis simplicibus vel trilobatis, superioribus lanceolatis integris, floribus inferioribus solitariis axillaribus superioribus corymbosis longe pedunculatis, bracteolis pluribus linearibus hispidis, calycis segmentis deltoideis acuminatis, petalis violaceis glabris, capsulæ valvis ovatis acuminatis.

A herb, with very slender elongated stems. Leaves distant, alternate; lower broad ovate, entire, or palmately 3-lobed, 1½–3 in. long; upper lanceolate, entire, shortly petioled, rounded at the base. Flowers in a corymb at the end of the stem and solitary from the axils of the upper leaves; peduncles slender, ¾–1½ in. long. Calyx ⅓ in. long; tube campanulate. Epicalyx of about 10 adpressed hispid linear bracteoles. Petals oblong, ½–¾ in. long. Valves of the hairy capsule rather longer than the calyx.—*Baron* 4533! 4581! 4675! 4679! 4797!

HIBISCUS CYTISIFOLIUS, n. sp.

Annuus, caulibus gracilibus elongatis scabris, foliis parvis petiolatis simplicibus vel digitatim trifoliolatis foliolis linearibus vel lineari-oblongis,

floribus solitariis axillaribus, bracteis pluribus liberis linearibus dense setoso-ciliatis, calycis tubo campanulato segmentis lanceolato-deltoideis tubo æquilongis, petalis luteis calyce duplo longioribus, genitalibus inclusis, fructu membranaceo globoso piloso magnitudine pisi.

An annual, with slender green stems a foot or more long. Leaves sometimes all simple, sometimes all trifoliolate; leaflets $\frac{1}{2}$–$\frac{3}{4}$ in. long, usually linear or linear-oblong, rarely ovate, moderately firm in texture, green and scabrous on both surfaces. Pedicel ascending, about an inch long. Calyx, capsule, and bracteoles all about $\frac{1}{4}$ inch long. Petals glabrous, obovate unguiculate. Capsule splitting to the base into 5 oblong-lanceolate valves $\frac{1}{8}$ in. broad.—*Baron* 703! 3942! 4594!

Hibiscus oblatus, n. sp.

Fructicosus, ramulis lignosis, foliis longe petiolatis integris orbiculari-oblatis subcoriaceis facie viridibus scabris dorso dense pubescentibus, floribus magnis axillaribus breviter pedicellatis solitariis, bracteolis 5 in cupulam magnam rigidam dentibus deltoideis coalitis, calycis tomentosi segmentis parvis ovatis, petalis pannosis obovato-unguiculatis, genitalibus longe exsertis.

A shrub, with terete woody branchlets, thinly clothed upwards with grey lepidote tomentum. Leaves 6–8 in. broad, 4–6 in. long, cordate at the base, broadly rounded at the apex, entire or nearly so, greenish and scabrous above, persistently matted beneath with soft whitish drab tomentum. Epicalyx drab, above $\frac{1}{2}$ in. long. Calyx under an inch long, matted with whitish-drab pubescence; segments $\frac{1}{8}$ in. long and broad. Petals pale brown, $1\frac{1}{4}$ in. long, densely pubescent. Column of stamens exserted nearly an inch beyond the petals.—*Baron* 3353! A very distinct large striking fruticose species, allied to *H. Ellisii*.

Hibiscus nummularifolius, n. sp.

Herbaceus, perennis, caulibus gracilibus apice stellato-pilosis, foliis petiolatis orbicularibus serratis facie calvatis subtus parce hispidis, floribus paucis axillaribus et terminalibus, bracteolis pluribus linearibus hispidis, calycis segmentis lanceolato-deltoideis, petalis violaceis glabris calyce duplo longioribus.

A much-branched perennial herb, with short slender stems. Leaves orbicular, subcoriaceous, under an inch long and broad; petioles $\frac{1}{3}$–$\frac{1}{2}$ in. long; stipules lanceolate, persistent. Flowers mainly solitary at the end of the branches. Calyx $\frac{1}{4}$ in. long; segments twice as long as the tube. Epicalyx of 10–12 linear

adpressed pectinate bracteoles. Petals $\frac{1}{3}$–$\frac{1}{2}$ in. long. Capsule not seen.—*Baron* 4827! Nearly allied to *H. xiphocuspis*, but quite different in the leaves.

Dombeya acerifolia, n. sp.

D. ramulis validis, stipulis orbicularibus pilosis persistentibus, foliis magnis longe petiolatis cordato-orbicularibus breviter palmatifidis denticulatis rugulosis utrinque pilosis, umbellis simplicibus multifloris axillaribus longe pedunculatis, pedicellis elongatis dense patentim pilosis, calycis dense hirsuti segmentis lanceolatis, petalis latis scariosis magnitudine mediocribus, staminodiis oblanceolatis, staminibus fertilibus 10 tubo urceolato.

A shrub, with stout woody branchlets. Leaves sometimes nearly a foot long and broad, with many unequal deltoid lobes, a basal sinus 1–1$\frac{1}{2}$ in. long, rugose like the leaf of a *Salvia*, thinly bristly above, lacunose and more densely pilose beneath; petiole 6–8 in. long; stipules persistent, coriaceous, cuspidate, $\frac{3}{4}$ in. in diam. Peduncles 5–6 in. long, densely clothed with soft brown spreading hairs. Umbel 4 in. in diam.; pedicels capillary, 1$\frac{1}{2}$ in. long. Calyx $\frac{1}{2}$ in. long, densely pilose. Petals $\frac{3}{4}$ in. long, reddish, scariose. Staminodia $\frac{1}{4}$ in. long. Anthers $\frac{1}{12}$ in. long. Style reaching nearly to the tip of the petals.—*Baron* 3446! A very handsome species, near *D. platanifolia*, Bojer.

Dombeya megaphylla, n. sp.

D. ramulis lignosis sursum tenuiter lepidotis, foliis longe petiolatis integris cordato-orbicularibus subcoriaceis facie viridibus glabris dorso tenuiter albido-lepidotis, floribus parvis in cymas densas axillares dichotomiter furcatas pedunculatas aggregatis, bracteis lanceolatis, calyce lepidoto segmentis oblongo-lanceolatis, petalis cuneatis scariosis, staminibus petalis brevioribus fertilibus 10 tubo brevi cupulari.

Branchlets stout, only thinly lepidote. Leaves $\frac{1}{2}$–1 ft. long and nearly as broad, entire, deeply cordate at the base, with strongly-raised veins beneath connected by cross veinlets; petiole 2–4 in. long. Flowers in dichotomous axillary cymes much shorter than the leaves. Bracts $\frac{1}{16}$ in. long. Calyx $\frac{1}{6}$ in. long, rough with persistent drab pubescence. Petals scariose, twice as long as the calyx. Staminodia linear, reaching to the tip of the petals. Stamens connate only at the very base.—*Baron* 3443! Allied to *D. spectabilis*, Bojer (*D. Humblotii*, Baillon). *D. lucida*, Baillon in Bull. Linn. Soc. Par. (1885) p. 496, is the same species as *D. floribunda*, Baker, founded on Baron's 2373.

Dombeya insignis, n. sp.

D. ramulis stellato-pilosis, foliis longe petiolatis cordato-ovatis acutis inciso-crenatis subcoriaceis facie viridibus calvatis dorso dense pubescentibus, floribus maximis solitariis cernuis axillaribus, bracteis persistentibus laceratis, calycis dense pilosi segmentis lanceolatis, petalis latis scariosis cuneatis, staminodiis longissimis, staminibus fertilibus 30 et ultra tubo brevi cupulari.

A shrub, with slender branches thinly tomentose upwards. Leaves 3–4 in. long, dotted over when young with stellate tufts of hairs above, densely matted beneath with pale brown pubescence; petiole $1\frac{1}{2}$–2 in. long, densely pubescent. Flowers solitary in the axils of the leaves; peduncle about an inch long. Bracts $\frac{1}{2}$ in. long. Calyx 1–$1\frac{1}{4}$ in. long, densely roughly stellato-pilose. Petals nearly 2 in. long, $\frac{3}{4}$–1 in. broad. Staminodia an inch long. Anthers linear, $\frac{1}{4}$ in. long, as long as the free part of the filament. Style reaching the tip of the petals.—*Baron* 3388! Nearly allied to *D. macrantha*, Baker (*Baron* 710! *Hildebrandt* 3895!). Belongs to the section *Trochetiantha* of Baillon.

Dombeya biumbellata, n. sp.

D. ramulis dense brunneo-pilosis, foliis longe petiolatis cordato-orbicularibus obscure palmatim trilobatis utrinque pilosis, umbellis furcatis axillaribus longe pedunculatis, pedicellis elongatis dense patentim pilosis, calycis dense pilosi segmentis ovato-lanceolatis, petalis cuneatis scariosis calyce sesquilongioribus, staminibus petalis brevioribus urceolo brevissimo, fertilibus 10.

A shrub, with branchlets, peduncles, and pedicels densely clothed with short soft brown pubescence. Leaves 6–8 in. broad, subcoriaceous, persistently pilose on both sides; petiole about as long as the lamina. Stipules deciduous. Umbels forked, about 2 in. in diam.; pedicels $\frac{1}{2}$-$\frac{3}{4}$ in. long. Calyx $\frac{1}{4}$ in. long, densely pilose. Petals much imbricated, truncate, $\frac{1}{3}$ in. long. Anthers and free filaments each $\frac{1}{12}$ in. long. Ovary densely pilose; style $\frac{1}{6}$ in. long.—*Baron* 3752! Allied to *D. viburnæfolia*, Bojer.

Dombeya (§ Hilsenbergia) Baroni, n. sp.

D. ramulis pilosis, stipulis deciduis, foliis longe petiolatis cordato-orbicularibus obscure palmatis utrinque persistenter pilosis, pedunculo elongato cernuo, floribus in cymam densam dichotomam dispositis, calycis dense pilosi tubo campanulato segmentis lanceolatis, petalis cuneatis rubellis scariosis calyce æquilongis, filamentis in tubum cylindricum calyce duplo longiorem coalitis, staminibus fertilibus circiter 15, staminodiis staminibus æquilongis, stylo exserto.

A shrub with pilose branches. Leaves 6–8 in. broad, deeply cordate, obscurely palmately lobed in the upper half, clothed with

short persistent pubescence on both sides; petiole 3–4 in. long. Peduncle 6–8 in. long. Cyme dense, 3–4 in. in diam. Calyx densely pilose; segments $\frac{1}{2}$ in. long. Staminal tube more than twice as long as the calyx and corolla. Anthers $\frac{1}{6}$ in. long; free apex of filament as long as the anther. Style exserted $\frac{1}{4}$ in. beyond the stamens.—*Baron* 3432! Closely allied to *D. cannabina*, Bot. Mag. t. 3619.

MELOCHIA (§ REIDLEIA) BETSILIENSIS, n. sp.

M. ramulis gracilibus apice obscure pilosis, foliis petiolatis ovato-lanceolatis serratis glabris, stipulis lanceolatis persistentibus, floribus axillaribus solitariis vel ad ramorum apice paucis corymbosis pedicellis brevibus, bracteolis 3 linearibus, calycis tubo campanulato dentibus parvis deltoideis, petalis lilacinis, filamentis in tubum cylindricum connatis apice liberis, fructu globoso haud inflato, stylis basi connatis.

A shrub with long slender terete brownish branches. Leaves 1–2 in. long, moderately firm in texture, green and glabrous on both surfaces, acute, rounded at the base, sharply serrated; petiole $\frac{1}{4}$–$\frac{1}{2}$ in. long. Stipules $\frac{1}{6}$ in. long. Flowers not more than 2–3 at the end of the branches, and one each from the axils of the upper leaves; pedicels hairy, at most $\frac{1}{4}$ in. long; bracteoles $\frac{1}{8}$ in. long. Calyx $\frac{1}{12}$ in. long and broad; teeth much shorter than the tube. Petals $\frac{1}{6}$ in. long. Stamens longer than the calyx. Capsule $\frac{1}{6}$ in. diam., setose.—*Baron* 271! 4678! 4757! Nearly allied to the widely-spread *M. corchorifolia*, Linn.

BYTTNERIA MELLERI, n. sp.

Arborea, ramulis rectis lignosis lepidoto-rugosis, foliis petiolatis cordato-orbicularibus apice profunde emarginatis lobis rotundatis rigide coriaceis facie viridibus glabris dorso dense lepidotis venis venulisque exsculptis, cymis axillaribus paucifloris, fructu magno globoso lepidoto echinato, valvis 5 lignosis e basi ruptis.

A tree 20 feet high, with stout woody branchlets. Leaves 2–3 in. long and broad, very thick, the apical sinus $\frac{1}{2}$–$\frac{3}{4}$ in. deep, the erecto-patent main veins of the under surface much raised, 4 radiating from the apex of the petiole, which is 1–$1\frac{1}{2}$ in. long. Flowers not seen. Capsule $1\frac{1}{2}$ in. long and broad, with 5 woody valves, armed with spreading prickles $\frac{1}{4}$ in. long, rough outside with scales, smooth inside, each half valve $\frac{1}{2}$ in. broad.—Anevoca, by streams and moist places in woods, *Dr. Meller*! Allied to *B. biloba*, Baill. Adans. x. 178.

BYTTNERIA BAUHINIOIDES, n. sp.

B. ramulis gracillimis apice tenuiter lepidotis, foliis petiolatis ovatis glabris

utrinque viridibus basi truncatis ex apice ad medium bifidis lobis deltoideis acutis, cymis axillaribus multifloris, bracteis deciduis, pedicellis flore longioribus, sepalis ovatis nigris lepidotis, petalis apice appendicibus ovatis præditis, urceolo stamineo calyce breviori.

A shrub, probably sarmentose, with slender blackish branches lepidote towards the tip only. Leaves about 3 in. long, moderately firm in texture, quite glabrous, cleft down to the middle or a little beyond; petiole slender, 1–1¼ in. long. Cymes about as long as the petiole; pedicels ⅙ in. long, slender, lepidote; bracts brown, lanceolate, deciduous. Calyx ⅛ in. long, blackish and thinly lepidote; segments connate at the base. Petals brown-purple, the brown tip exserted beyond the calyx. Staminal urceolus campanulate, dark purple. Fruit not seen.—*Baron* 4627! Allied to *B. heterophylla*, Hook. Bot. Misc. i. 291, t. 61.

Corchorus hamatus, n. sp.

Annuus, caulibus elongatis erectis gracilibus glabris, foliis breviter petiolatis membranaceis glabris lanceolatis vel oblongo-lanceolatis acutis argute serratis basi bi-aristatis, floribus paucis axillaribus brevissime pedicellatis, sepalis oblongis membranaceis cuspidatis, petalis orbiculari-unguiculatis luteis, antheris linearibus filamentis brevibus, fructu duro cylindrico curvato rugoso rostro cylindrico integro.

An annual, with elongated slender glabrous stems. Leaves 2–3 in. long, ½–¾ in. broad, thin in texture, sharply serrated, with a large awn from each side at the base; petiole very short; stipules lanceolate acuminate, persistent. Flowers 3–4 from the axils of the leaves. Sepals membranous, ⅙ in. long, with a large cusp at the tip. Petals bright yellow, ¼–⅓ in. long. Stamens about 30; anthers linear, ⅙ in. long, twice as long as the filaments. Capsule sickle-shaped, abruptly curved, ½ in. long, ⅙ in. in diam., narrowed gradually into a cylindrical beak ¼ in. long, obscurely lobed at the tip only.—*Baron* 4712! Mojanga, *Hildebrandt* 3409!

Elæocarpus dalechampioides, n. sp.

Arborea, ramulis pilosis, foliis petiolatis alternis vel oppositis obovato-oblongis obtusis subintegris rigide coriaceis subtus pilosis, pedicellis cernuis, sepalis subcoriaceis tomentosis lanceolato-deltoideis reflexis, petalis latis cuneatis rubellis pubescentibus margine laciniatis, antheris apiculatis dense pilosis.

A tree, with moderately stout pilose branchlets. Leaves 4–5 in. long, 1½–2½ in. broad, very obtuse, entire or obscurely denticulate, rounded at the base, green and glabrous on the upper surface when mature, softly pilose, especially on the main veins

beneath, with 6–8 pairs of much-raised main veins on each side; petiole $\frac{1}{3}$–$\frac{1}{2}$ in. long. Pedicels cernuous, 1–1$\frac{1}{2}$ in. long. Calyx coriaceous, $\frac{1}{3}$ in. long; sepals connate above the base. Petals an inch long, nearly an inch broad, dark red, much imbricated, pubescent on the outside mainly on the flabellate ribs. Stamens very numerous, half as long as the petals; anthers densely pilose, narrowed into an apiculus $\frac{1}{8}$ in. long above the cells.—*Baron* 3822! Allied to *E. rhodanthus* and *quercifolius*.

PSOROSPERMUM EMARGINATUM, n. sp.

Fruticosum, ramulis glabris ancipitibus, foliis distincte petiolatis oblongis obtusis vel emarginatis basi deltoideis utrinque viridibus glabris, umbellis multifloris pedunculatis terminalibus, pedicellis elongatis glabris, sepalis oblongis glabris valde nigro-lineatis, petalis calyce sesquilongioribus facie dense pilosis, staminibus pentadelphis antheris circiter 35.

A shrub, glabrous in all its parts except the face of the petals, the branchlets distinctly flattened towards the tip. Leaves 2–3 in. long, moderately firm in texture, green and glabrous on both sides; lower surface paler; main veins distinct, distant; petiole $\frac{1}{4}$–$\frac{1}{3}$ in. long. Flowers 15–30 in an umbel; peduncle 1–1$\frac{1}{2}$ in. long; pedicels $\frac{1}{3}$–$\frac{1}{2}$ in. long. Calyx $\frac{1}{6}$ in. long; sepals glabrous, with copious black lines and dots outside. Petals $\frac{1}{4}$ in. long, very hairy on the face. Stamens as long as the calyx. Free styles as long as the ovary.—*Baron* 4397!

PSOROSPERMUM POPULIFOLIUM, n. sp.

Fruticosum, ramosissimum, ramulis apice ferrugineo-pilosis, foliis distincte petiolatis oblongis acutis obscure crenulatis adultis utrinque glabris viridibus, umbellis terminalibus multifloris, pedicellis pilosis flore longioribus, sepalis oblongis pilosis, petalis oblanceolatis calyce duplo longioribus facie pilosis, staminibus pentadelphis antheris circiter 40.

A much-branched erect shrub, the slender branchlets pilose towards the tip only. Adult leaves 2–3 in. long, acute, generally narrowed to the base, moderately firm in texture, green on both sides, the main veins distant, arcuate; young leaves matted with brown pubescence on both sides. Umbels 1–2 from the axils of the top leaves; peduncle and pedicels brown-pilose, the latter $\frac{1}{4}$–$\frac{1}{3}$ in. long. Calyx $\frac{1}{12}$ in. long. Petals $\frac{1}{6}$ in. long, lineolate and hairy on the face. Stamens and pistil both as long as the petals.—*Baron* 4611! 4617! 4810! 4812! Allied to *P. Fanerana*, Baker, in Journ. Bot. 1882, p. 19.

PELARGONIUM (§ PELARGIUM) MADAGASCARIENSE, n. sp.

Perenne, caulibus erectis elongatis pilosis, foliis petiolatis membranaceis cordato-orbicularibus parce pilosis breviter lobatis inciso-crenatis, umbellis 3–4-floris, bracteis ovato-lanceolatis, pedicellis flori æquilongis, calycis calcare brevi segmentis ovato-lanceolatis, petalis parvis anguste cuneatis pallide lilacinis superioribus majoribus deorsum venosis, carpellorum rostro cylindrico pubescente.

A perennial, with a fusiform root and tufted leafy erect pubescent stems above a foot long. Basal leaves with a petiole 3–4 in. long, and a blade 3 in. broad, and basal sinus an inch deep; upper growing gradually smaller; lobes 3–5, shallow. Umbels produced from the axils of the leaves all down the stem; pedicels under ½ in. long; bracts 5–6, membranous, pilose. Calyx ¼ in. long, exclusive of the short spur. Petals ⅓ in. long. Beak of the carpels ½ in. long, with a short style and 5 revolute stigmas.—*Baron* 3422! This is the first *Pelargonium* that has been found in Madagascar. It is allied to the Cape *P. alchemilloides* and the Abyssinian *P. glechomoides*.

IMPATIENS HILDEBRANDTII, *Baill. in Bull. Linn. Soc. Par.* (1886) p. 595.

Herbacea, perennis, glabra, caulibus erectis simplicibus gracilibus, foliis oblongis vel oblongo-lanceolatis acutis integris vel parce dentatis breviter petiolatis, floribus corymbosis longe pedicellatis, sepalis lateralibus parvis lanceolatis, postico magno ovato-naviculari calcare gracillimo unciali, petalis rubellis supremo orbiculari inferioribus cuneatis bifidis sepalo postico longioribus, ovario clavato glabro.

A herbaceous perennial, glabrous in all its parts, with slender simple erect stems a foot or more long. Leaves 10–12 to a stem, distant, membranous, 1–3 in. long, narrowed from the middle to the apex and base, often furnished with 1–2 bristles at the apex of the petiole. Flowers many to a stem from the top and axils of the upper leaves; pedicels very slender, 1–2 in. long. Blade of the spurred sepal ⅓ in. long. Petals reddish, the two lower ½–⅝ in. long. Capsule glabrous, narrowed from the middle to the apex and base.—*Baron* 3704! 3935! Also *Hildebrandt* 3828, from shady woods in the province of Imerina. Nearly allied to *I. firmula*, Baker. Hildebrandt's 3382, also named *I. Hildebrandtii* by Dr. Baillon, is *I. emirnensis*, Baker.

TRIMORPHOPETALUM, gen. nov. Balsaminearum.

Sepala 3, 2 lateralia parva lanceolata viridia; posticum maximum galeatum haud calcaratum petaloideum venosum. Petala 3, anticum externum concavum sepalo postico simile; lateralia orbiculato-cuneata

unguiculata, unguibus basi unilateraliter auriculatis. Stamina 5, filamentis cohærentibus circiter ovarium conniventibus, antheris apicalibus. Ovarium obliquum 5-carpellatum, ovulis multis axillibus superpositis, stigmate sessili capitato. Fructus maturus ignotus.

T. DORSTENIOIDES, *Baker*.

Species sola.

Root-stock slender, creeping, sending out simple, erect, rather fleshy fragile stems 6–9 in. long, glanduloso-viscose, especially towards the top. Leaves 5–6 to a stem, all arising from its upper half, ascending, distinctly petioled, oblong, acute, membranous, glabrous, 1½–2 in. long, deltoid and entire at the base, shallowly broadly toothed, with little glandular cusps in the sinuses. Flowers solitary, lateral, pedicellate, with two small bracteoles outside the two lateral sepals. Green membranous lateral sepals $\frac{1}{12}$ in. long. Upper galeate sepal $\frac{1}{3}$ in. long, veined with brown on a drab-whitish groundwork, like an *Aristolochia*. Lateral petals with a blade $\frac{1}{6}$ in. long and broad, and a claw $\frac{1}{6}$ in. long, auricled on the outer side. Ovary and stamens $\frac{1}{6}$ in. long before the petals fall.—*Baron* 4476! A very distinct new generic type nearest *Impatiens*.

ERYTHROXYLUM SPARSIFLORUM, n. sp.

Ramosissimum, glabrum, foliis parvis breviter petiolatis oblongis obtusis subcoriaceis utrinque viridibus basi cuneatis, stipulis ovatis, floribus 1–2-nis axillaribus pedicellis brevibus, sepalis ovatis acutis basi coalitis, petalis oblongis calyce 2–3plo longioribus, staminibus petalis subæquilongis.

A much-branched shrub, glabrous in all its parts; branchlets slightly compressed. Leaves rigid in texture, 1–1½ in. long, narrowed from the middle to the base and point, the main veins raised beneath, anastomosing by cross veinlets close to the margin; petiole very short; stipules and bracts ovate, acute. Flowers 1–2nate; pedicels $\frac{1}{8}$–$\frac{1}{6}$ in. long. Calyx $\frac{1}{2}$ line long. Petals $\frac{1}{12}$ in. long. Stamens nearly equalling the petals; anthers oblong, minute; filaments joined at the base in a cup.—*Baron* 4519!

ERYTHROXYLUM AMPULLACEUM, n. sp.

Glabrum, ramulis compressis, stipulis ovatis, foliis breviter petiolatis oblongis obtusis subcoriaceis basi deltoideis, floribus 1–2nis axillaribus, pedicellis elongatis, sepalis oblongo-lanceolatis, filamentis elongatis basi coalitis, fructu ampullæformi.

A shrub, glabrous in all its parts, with flattened branchlets.

Leaves alternate, laxly disposed, moderately firm in texture, 2–2½ in. long, green and glabrous on both surfaces, with about 12 pairs of raised veins beneath anastomosing by cross veinlets some distance from the edge; petiole very short; stipules $\frac{1}{6}$ in. long. Pedicels ¾ in. long. Sepals oblong-lanceolate, reflexing, persistent, $\frac{1}{12}$ in. long. Free filaments $\frac{1}{12}$ in. long. Immature fruit ampullæform, ¼–⅓ in. long.—*Baron* 3688!

TRISTELLATEIA EMARGINATA, n. sp.

Sarmentosa, ramulis glabris, foliis petiolatis oblongis subcoriaceis emarginatis basi cuneatis utrinque viridibus glabris, racemis paucifloris brevibus, pedicellis elongatis, sepalis oblongo-lanceolatis, ovario conico piloso, stylo brevi, samaræ alis circiter 18 rigidis cuneatis patulis basi pilosis.

A climber, with terete glabrous branchlets. Leaves 2–3 in. long, moderately firm in texture, green and quite glabrous on both surfaces, obtuse, conspicuously emarginate, deltoid at the base. Racemes 4–6 in. long, short peduncle included; pedicels 1–1½ in. long, lower sometimes branched. Calyx $\frac{1}{6}$ in. long. Petals and stamens not seen. Wings of the fruit ⅓ in. long, ⅛ in. broad at the tip, narrowed gradually to the base.—*Baron* 3078!

TRISTELLATEIA STENOPTERA, n. sp.

Sarmentosa, foliis oppositis longe petiolatis subcoriaceis ovatis facie glabris dorso pubescentibus, racemis laxis longissimis, pedicellis arcuatis flore longioribus, sepalis oblongis crispatis dense pilosis, petalis oblongis unguiculatis, antheris lanceolatis filamento longioribus, ovario piloso globoso, stylo elongato, samaræ alis circiter 15 angustis pubescentibus.

A climber, with slender terete branchlets. Leaves 3–4 in. long, moderately firm in texture, slightly cordate, deltoid at the apex, when mature green and glabrous above, thinly coated with pale pubescence beneath, with about 6 pairs of arcuate main veins. Racemes axillary and terminal, the end ones 8–9 in. long; lower pedicels ¾–1 in. long. Calyx $\frac{1}{6}$ in. long. Petals bright yellow, ⅓ in. long. Wings of the fruit ½ in. long, $\frac{1}{12}$ in. broad at the tip, sometimes emarginate.—*Baron* 4754!

EVODIA DISCOLOR, n. sp.

Arborea, ramulis apice pubescentibus, foliis simplicibus lanceolatis vix petiolatis obscure pubescentibus facie viridibus dorso pallidis, floribus tetrameris in paniculam densam terminalem ramis deltoideis dispositis, pedicellis brevibus pubescentibus, calycis segmentis orbicularibus, petalis

oblongis crebre nigro-punctatis, staminibus exsertis, pistillo in flore masculo rudimentario.

A tree, with branchlets pubescent and flattened at the tip. Leaves subcoriaceous, subobtuse, sometimes half a foot long, an inch broad at the middle, narrowed to the base, greenish white beneath, with raised main veins and copious minute immersed dots. Panicles on pubescent peduncles from the axils of the large uppermost leaves. Calyx $\frac{1}{12}$ in. in diam., brown, pubescent. Corolla $\frac{1}{12}$ in. long. Female flower and fruit not seen.—*Baron* 3754!

EVODIA FLORIBUNDA, n. sp.

Arborea, ramosissima, glabra, foliis longe petiolatis trifoliolatis, foliolis oblongis cuspidatis basi attenuatis, floribus tetrameris in paniculas densas terminales corymbosas dispositis, pedicellis pubescentibus flori æquilongis, calycis pilosi segmentis orbicularibus, petalis oblongis pallidis dense glanduloso-punctatis, staminibus exsertis, pistillo in flore masculo rudimentario.

A much-branched erect tree, with slender terete brown glabrous branchlets. Petiole 1–2 in. long; leaflets 2–4 in. long, moderately firm in texture, green and glabrous on both surfaces, dotted with copious minute immersed black glands, cuneately narrowed at the base into a short winged petiolule. Flowers in copious ample dense terminal panicles, about as long as the upper leaves; branches erecto-patent; final branchlets densely corymbose. Calyx $\frac{1}{2}$ line in diam., brown, densely pubescent. Petals $\frac{1}{8}$ in. long. Filaments finally as long as the petals; anthers oblong, versatile.—*Baron* 2221!

OCHNA MACRANTHA, n. sp.

Glabra, ramulis gracilibus, foliis breviter petiolatis oblongo-lanceolatis subobtusis denticulatis, cymis axillaribus paucifloris, pedicellis elongatis, sepalis oblongis magnis inæqualibus, petalis magnis luteis orbiculari-unguiculatis, staminibus permultis antheris linearibus, carpellis maturis turbinatis.

A tree, glabrous in all its parts, with slender terete branchlets. Leaves moderately firm in texture, 3–4 in. long, an inch broad at the middle, rather glossy above, green on both sides, finely veined, ciliato-denticulate; petiole not more than $\frac{1}{8}$–$\frac{1}{6}$ in. long. Cymes axillary, 3–4-flowered; pedicels spreading, $\frac{1}{2}$–$\frac{3}{4}$ in. long. Sepals $\frac{1}{2}$–$\frac{3}{4}$ in. long, green, glabrous, firm in texture. Petals bright yellow, an inch long, with a blade $\frac{1}{2}$ in. broad, cuneate at the base, and a distinct claw. Stamens half as long as the petals.

Fruit-carpels much shorter than the persistent calyx.—*Baron* 3927! 4811! 4818! Native name *Lanary*. Allied to *O. ciliata*, Lam.

Apodytes emirnensis, n. sp.

Arborea, ramulis glabris, foliis petiolatis oblongis acutis basi deltoideis dorso obscure pubescentibus, floribus in paniculas multifloras axillares pedunculatas dispositis, pedunculis pedicellisque pilosis, calyce parvo dentibus deltoideis, petalis oblanceolatis obtusis, staminibus petalis æquilongis antheris oblongis, ovario ovoideo stylo brevi.

A tree, with slender woody naked branchlets. Leaves 3–4 in. long, 18–21 lines broad, quite entire, moderately firm in texture, finely veined, only slightly pubescent on the midrib beneath. Panicles 2–3 in. in diam., 3–4-pinnate; branches pubescent; ultimate pedicels much shorter than the flowers; bracts minute, ovate. Flowers pentamerous. Calyx $\frac{1}{3}$ line in diam., pubescent. Bud oblong, glabrous, $\frac{1}{12}$ in. long. Anthers as long as the filaments, oblong, reaching to the tip of the petals.—*Baron* 4791! 4865! Nearly allied to the Mauritian *A. mauritiana*, Planch.

Turræa rhombifolia, n. sp.

Glabra, foliis parvis rhomboideis breviter petiolatis, floribus solitariis tetrameris terminalibus breviter pedunculatis, calycis parvi tubo campanulato segmentis ovatis acutis, petalis luteis oblongo-lanceolatis longe unguiculatis, tubo stamineo cylindrico petalis æquilongo, staminodiis parvis lanceolatis profunde bifidis, antheris dense pilosis connectivo producto apiculatis, stigmate exserto capitato.

A tree or shrub, with slender glabrous branchlets. Leaves moderately firm in texture, not more than $\frac{1}{2}$–$\frac{3}{4}$ in. long, cuneate at the base, green and glabrous on both surfaces. Pedicels slender, glabrous, $\frac{1}{4}$ in. long. Calyx $\frac{1}{8}$ in. long. Petals an inch long, $\frac{1}{8}$–$\frac{1}{4}$ in. broad. Filaments united in a cylindrical column an inch long; teeth 8, laciniated at the tip; anthers $\frac{1}{12}$ in. long, very hairy. Style reaching to the tip of the anthers; stigma capitate.—*Baron* 4569!

Turræa venulosa, n. sp.

T. ramulis pilosis, foliis oblongis acutis rigide coriaceis facie nitidis viridibus dorso obscure pubescentibus venis exsculptis, floribus solitariis tetrameris breviter pedicellatis, calycis pilosi segmentis lanceolatis, petalis oblanceolatis unguiculatis, tubo stamineo cylindrico petalis æquilongo, dentibus quadratis bifidis, antheris 8 glabris connectivo producto apiculatis, stylo longe exserto.

A tree or shrub, with long slender pilose branchlets. Leaves 1–2 in. long, shortly petioled, rigid in texture, bright green above, dull green beneath, with the main veins much raised and connected by arches within the margin. Pedicels $\frac{1}{4}$ in. long, Calyx $\frac{1}{4}$ in. long; teeth shorter than the tube. Petals $1\frac{1}{2}$ in. long. Filaments united in a cylindrical tube as long as the petals, with 8 minute quadrate bifid teeth. Anthers $\frac{1}{12}$ in. long. Style exserted half an inch beyond the stamens.—*Baron* 4199!

COMMIPHORA (BALSAMODENDRON) FRAXINIFOLIA, n. sp.

Arborea, glabra, ramulis validis inermibus, foliis imparipinnatis longe petiolatis utrinque viridibus glabris, foliolis 5–7 ovatis vel oblongis sessilibus, paniculis axillaribus laxis foliis brevioribus, ramis inferioribus paucis brevibus corymbosis, pedicellis gracilibus flore interdum longioribus, calycis segmentis ovatis, petalis angustis calyce paulo longioribus, ovario ampullæformi glabro stigmate sessili coronato.

A tree, with stout glabrous brown sulcate branchlets. Leaves 8–9 in. long, including the 2–3 in. petiole; leaflets 3–4 in. long, shallowly crenate, moderately firm in texture, green and glabrous on both surfaces. Panicles crowded at the end of the branchlets, contemporary with the young leaves, 2–3 in. long, very lax, the lower branches sparingly compound; pedicels slender, $\frac{1}{6}$–$\frac{1}{4}$ in. long. Calyx glabrous, $\frac{1}{8}$ in. long; tube short, campanulate; segments acute, firm in texture. Petals oblanceolate, $\frac{1}{6}$ in. long. Ovary glabrous, narrowed very gradually to the sessile stigma.—*Baron* 4404!

COMMIPHORA (BALSAMODENDRON) LAXIFLORA, n. sp.

Arborea, ramulis validis junioribus pilosis, foliis longe petiolatis imparipinnatis utrinque viridibus pilosis, foliolis 5–7 oblongis cuspidatis serratis, racemis elongatis laxissimis breviter pedunculatis, pedicellis crassis brevibus infimis furcatis, calycis segmentis ovatis rigide coriaceis glabris.

A tree, with stout branchlets, at first pilose. Leaves 8–9 in. long, including the 3-inch petiole; leaflets 2–4 in. long, the end one largest, minutely serrated, rounded at the base, moderately firm in texture, green and obscurely pilose above, paler and more hairy beneath, with 8–10 pairs of fine ascending raised main veins. Racemes axillary, as long as the leaves; rhachis slender, glabrous; flowers few, distant, solitary except the very lowest; pedicels $\frac{1}{12}$–$\frac{1}{8}$ in. long. Sepals 4, ovate, decussate, $\frac{1}{12}$ in. long. Petals and fruit not seen.—*Baron* 4837! Closely allied to *C. grandifolia*, Engler.

GYMNOSPORIA CUNEIFOLIA, n. sp.

Glabra, ramulis virgatis angulosis spinosis, foliis parvis obovatis obtusis fasciculatis brevissime petiolatis, floribus in cymis axillaribus paucifloris dispositis, pedicellis brevibus, calycis segmentis ovatis, fructu valvis tribus latis patentibus emarginatis, seminibus ovoideis castaneis.

A shrub or tree, with long slender angled branchlets, bearing tufts of leaves in the axils of pungent straight slender spines $\frac{1}{6}$–$\frac{1}{4}$ in. long. Leaves firm in texture, very obtuse, pale green and glabrous on both surfaces, usually about half an inch long. Cymes usually one from each of the fascicles of leaves, which they slightly overlap, few-flowered; pedicels finally $\frac{1}{6}$ in. long. Petals and stamens not seen. Fruit-valves rigidly coriaceous, $\frac{1}{6}$ in. long and broad. Seeds ovoid, bright brown, 2 to each cell.—*Baron* 4201! Closely allied to *G. berberidacea*, Baker, which has just the same *Berberis*-like habit.

ELÆODENDRON GYMNOSPOROIDES, n. sp.

Fruticosa, glabra, ramulis gracilibus, foliis parvis oblongis obtusis obscure crenulatis, floribus in cymis 2–3-floris dispositis, pedicellis strictis flore longioribus, calycis tubo brevissimo dentibus ovatis, petalis orbicularibus, staminibus brevibus, disco pentagono, ovario obconico stigmate sessili.

An erect shrub or small tree, with very slender branchlets. Leaves alternate, shortly petioled, $\frac{3}{4}$–1 in. long, deltoid or rather rounded at the base, finely veined. Cymes axillary or terminal; pedicels $\frac{1}{12}$–$\frac{1}{8}$ in. long. Bud globose. Calyx $\frac{1}{12}$ in. in diam. Corolla greenish yellow, $\frac{1}{8}$ in. in diam. Fruit not seen.—*Baron* 3735!

VITIS (§ AMPELOCISSUS) SPHÆROPHYLLA, n. sp.

Sarmentosa, glabra, cirrhifera, foliis membranaceis longe petiolatis digitatis, foliolis 5 longe petiolulatis magnis orbicularibus denticulatis, floribus pentameris in paniculas bipinnatas ramulis racemosis dispositis, pedicellis brevissimis, calyce patellæformi piloso subintegro, petalis oblongis, staminibus brevibus.

A large climber, with rather stout angled woody stems. Leaves digitately 5-foliolate; petiole 2 in. long; upper leaflets 3–4 in. long and broad, much imbricated, rounded or shallowly cordate at the base, with distinct petiolules $\frac{1}{2}$–1 in. long; two outer leaves smaller, cuneate at the base. Panicles thyrsoid, peduncled, lateral; branches pubescent. Buds globose. Flowers very small. Fruit not seen.—*Baron* 4841!

VITIS (§ AMPELOCISSUS) RHODOTRICHA, n. sp.

Sarmentosa, cirrhifera, ramulis gracilibus lignosis sursum ferrugineo pubescentibus, foliis simplicibus cordato-ovatis denticulatis facie viridibus glabris dorso ferrugineo-pubescentibus, paniculæ ramis dense corymbosis pedunculis pedicellisque dense ferrugineo-pilosis, floribus pentameris, calyce obscure dentato, petalis parvis glabris sordide purpureis, ovario glabro.

A climbing shrub, with slender woody branchlets, clothed upwards, like the panicle and underside of the leaves, with dense bright ferruginous pubescence. Leaves 3–4 in. long and broad, moderately firm in texture, ferruginous on the raised veins beneath, with a broad open basal sinus. Panicles thrysoid, with distant short erecto-patent densely corymbose main branches; pedicels finally longer than the flowers. Bud globose, under a line in diameter. Calyx patellæform, densely ferrugineo-pubescent. Petals not more than a line long. Ovary glabrous; style as long as the ovary.—*Baron* 4749! 4838! Nossi-bé, *Hildebrandt* 2876!

VITIS (§ CISSUS) VOANONALA, n. sp.

Sarmentosa, copiose cirrhifera, ramulis gracillimis brevissime pubescentibus, foliis bipinnatis membranaceis glabris, foliolis serratis obovatis vel oblongis, floribus tetrameris corymboso-paniculatis, pedunculis pedicellisque pubescentibus, calyce patellæformi vix dentato, petalis parvis ovatis viridibus, fructu immaturo turbinato glabro.

A climber, with very slender stems and copious tendrils. Fully-developed leaves 6–8 in. long, including the long petiole; blade simply pinnate in the upper half, bipinnate at the base; leaflets 12–20 to a leaf, about an inch long, bright green, deltoid or rounded at the base. Panicles lax, axillary or terminal, 1–3 in. broad; pedicels very short. Flower-calyx $\frac{1}{2}$ lin. in diam. Bud globose. Ovary globose; style very short; stigma capitate.—*Baron* 4561! *Dr. Parker*! Native name *Voanonala*. Allied to *V. microdiptera*, Baker. In a fully-developed leaf there are 5 leaves above a branch, 2 branches with 3 pairs of leaves and 2 with 5 pairs.

LEEA CUSPIDIFERA, n. sp.

Fruticosa, ramis pubescentibus, foliis longe petiolatis rhomboideis tripinnatis, foliolis ovatis vel oblongis serratis conspicue cuspidatis facie viridibus glabris dorso pallide viridibus ad venas hispidis, floribus copiose corymboso-paniculatis, pedicellis calyci æquilongis, calycis tubo campanulato dentibus ovatis, petalis rubellis, tubo stamineo ad medium quinquefido dentibus quadratis erectis emarginatis.

A climbing shrub, with pubescent woody branchlets. Petiole 5 in. long; blade 6–8 inches long and broad; leaflets $\frac{3}{4}$–$1\frac{1}{2}$ in. long, moderately firm in texture, bright green above. Panicle dense, 2 in. in diam.; branches densely pubescent; bracts minute, lanceolate. Calyx pubescent, $\frac{1}{12}$ in. in diam.; teeth shorter than the tube. Petals reflexing, $\frac{1}{8}$ in. long. Corona rather shorter than the petals, deeply 5-cleft.—*Baron* 4785!

Tina velutina, n. sp.

Arborea, ramulis velutinis, foliis confertis subcoriaceis facie parce dorso dense brunneo-pilosis, foliolis 11–13 oblongis acutis serratis venulis faciei inferioris exsculptis, floribus paniculatis, pedicellis brevibus, bracteis minutis deltoideis, calycis segmentis parvis obtusis, petalis calyce duplo longioribus, fructu turbinato glabro.

A tree, with the leaves and panicles crowded towards the end of the velvety branchlets. Leaves half a foot long including the short petiole; upper leaflets 2–3 in. long, acute or obtuse, with a cusp; texture slightly coriaceous; main veins of the under surface numerous, prominently raised. Panicles about as long as the leaves; pedicels finally $\frac{1}{6}$ in. long. Calyx $\frac{1}{8}$ in. in diam.; segments very short, obtuse. Fruit turbinate, glabrous.—*Baron* 1457! 1522! 3968! Differs from *T. dasycarpa* by its acute serrated leaflets.

Calycifloræ.

Byrsocarpus Baroni, n. sp.

B. ramis crebre lenticillatis, ramulis dense pubescentibus, foliolis 20–24 petiolulatis oblongis obtusis glabris, floribus cum foliis immaturis productis, cymis densis paucifloris, pedicellis pubescentibus prope apicem articulatis, sepalis ovatis obtusis pilosis, petalis oblanceolatis calyce 3–4plo longioribus, staminibus longioribus petalis paulo brevioribus, carpellis pilosis, stylo brevi, stigmate capitato.

A shrub or tree, with densely pubescent final branchlets. Fully developed leaves 4–5 in. long, including the short petiole; leaflets thin, about an inch long. Flowers contemporary with the young leaves. Calyx very hairy, $\frac{1}{12}$ in. in diam.; segments pilose, much imbricated. Petals $\frac{1}{6}$ in. long. Filaments long; anthers small, globose. Carpels hairy, about as long as the calyx. Fruit not seen.—*Baron* 4922! The genus *Byrsocarpus* is united by Dr. Baillon with *Rourea*.

Crotalaria luteo-rubella, n. sp.

Fruticosa, glabra, ramulis gracilibus, foliis longe petiolatis trifoliolatis

foliolis magnis oblongis acutis, racemis terminalibus laxis multifloris, pedicellis elongatis, bracteis minutis caducis, calyce glabro tubo campanulato dentibus acutis tubo æquilongis, petalis glabris calyce duplo longioribus, vexillo rubello carina alisque luteis, legumine oblongo-clavato rigidulo 2-3-spermo longe stipitato.

A much-branched shrub, with slender terete virgate branchlets. Petiole 1½–2 in. long; leaflets membranous, sometimes 3–4 in. long, green and glabrous on both sides. Racemes 4–5 in. long; lower pedicels ¼ in. long. Calyx broadly campanulate, ⅛ in. in diam.; teeth lanceolate from a broad base. Corolla ⅓ in. long; keel broad, with a conspicuous erect beak. Pod glabrous, rigid in texture. Pod 1 in. long, ¼ in. in diam., with a slender gynophore ⅓ in. long.—*Baron* 4708! 4856! *Hildebrandt* 3441! Near *C. striata*, DC., and *C. Pervillei*, Baill.

CROTALARIA MACROPODA, n. sp.

Fruticosa, ramulis gracilibus obscure strigillosis, stipulis minutis caducis, foliis trifoliolatis facie viridibus glabris dorso tenuiter pilosis, foliolis oblongis acutis vel obtusis, racemis laxis terminalibus paucifloris, pedicellis calyci æquilongis, bracteis minutis ovatis caducis, calyce dentibus lanceolatis tubo duplo longioribus, petalis rubellis glabris calyce duplo longioribus, ovario oblongo 4-ovulato.

A much-branched erect shrub, with slender terete branchlets. Petiole 1–1½ in. long; leaflets 1–2 in. long, moderately firm in texture, green on both surfaces. Racemes copious, lax, 1–2 in. long; pedicels finally ¼ in. long. Calyx ¼ in. long, slightly silky; tube very short; teeth lanceolate acute. Corolla ½ in. long; standard ⅓ in. broad; keel broad, rostrate, up-curved. Mature pod not seen.—*Baron* 3789! 3862! Near *C. striata*, DC.

INDIGOFERA DESMODIOIDES, n. sp.

Fruticosa, ramulis apice strigillosis, stipulis linearibus, foliis imparipinnatis breviter petiolatis rigidulis siccitate nigrescentibus utrinque albo-strigillosis, foliolis 25–27 lanceolatis petiolulatis mucronatis, racemis densis subsessilibus axillaribus multifloris, pedicellis brevibus, calyce parvo late campanulato dentibus parvis lanceolatis, petalis glabris calyce multo longioribus, legumine curvato conspicue toruloso 4–6-spermo.

A shrub, with long slender woody branchlets. Leaves 2–3 in. long; leaflets about ½ in. long, ½ line broad, firm in texture, turning blackish when dried, like those of *I. Anil* and *I. tinctoria*. Racemes copiously produced in the axils of the leaves; pedicels about as long as the calyx, finally cernuous. Calyx ½ line in diam.; tube campanulate, strigillose. Corolla ⅙ in. long. Pod sickle-

shaped, under an inch long, conspicuously torulose, naked when mature, black.—*Baron* 889! 3965! Group of *I. tinctoria.*

INDIGOFERA ORMOCARPOIDES, n. sp.

Fruticosa, ramulis gracilibus obscure strigillosis, stipulis lanceolatis minutis, foliis membranaceis petiolatis utrinque obscure albo-hispidulis, foliolis 5–7 oblongis petiolulatis stipellatis, racemis axillaribus, floriferis densis brevibus subsessilibus, fructiferis elongatis, pedicellis calyci æquilongis, bracteis lanceolatis caducis, calyce parvo piloso dentibus deltoideis, petalis pilosis sordide luteis, legumine gracili elongato toruloso 5–6-spermo.

A shrub, with slender terete branchlets. Leaves 3–4 in. long, including the $\frac{3}{4}$ in. petiole; leaflets opposite, 1–2 in. long, mucronate, thin in texture, thinly clothed with adpressed white bristles on both surfaces. Flower-racemes about an inch long, nearly sessile, much shorter than the leaves. Calyx oblique, broadly campanulate, $\frac{1}{2}$ lin. in diam.; teeth minute. Corolla $\frac{1}{6}$ in. long. Pod 2 in. long whilst still immature, glabrous, conspicuously torulose.—*Baron* 4607! 4734! 4822! Group of *I. tinctoria.*

MUNDULEA LAXIFLORA, n. sp.

Fruticosa, ramulis gracilibus velutinis, stipulis lanceolatis persistentibus, foliis imparipinnatis subcoriaceis facie tenuiter dorso dense sericeis, foliolis 7–9 obovatis vel oblongis petiolulatis, racemis laxis, pedicellis calyci æquilongis, bracteis caducis, calyce sericeo tubo campanulato dentibus acuminatis, petalisrubellis sericeis, legumine velutino.

A shrub, with slender terete woody velvety branchlets. Leaves 3–4 in. long, including the $\frac{3}{4}$–1 in. petiole; upper leaflets 1–1$\frac{1}{2}$ in. long; side ones opposite; upper subacute; lower shorter, obovate, obtuse. Racemes 2–4 in. long; lower pedicels $\frac{1}{6}$ in. long. Calyx silky, broadly campanulate, $\frac{1}{6}$ in. long; teeth deltoid-cuspidate; upper as long as the tube, lower longer. Corolla $\frac{1}{2}$ in. long; standard silky on the outside. Pod linear, not seen fully mature.—*Baron* 3861!

LEPTODESMIA CONGESTA, *Benth.*

The Madagascar *Desmodium lespedezioides*, Benth. in Plant. Junghuhn. p. 223, of which we have specimens from Ellis, Bojer, and Parker, seems to be conspecific with the Indian *Leptodesmia congesta*, Benth. MSS.; Baker in Hook. fil. Fl. Brit. Ind. ii. p. 152. *Hallia? Bojeriana*, Baill. in Bull. Linn. Soc. Par. p. 432, is a

very distinct second species of *Leptodesmia*, endemic in Madagascar. We have specimens from Bojer and Justice Blackburn. It has a 1-jointed 1-seeded suborbicular compressed legume $\frac{1}{6}$ in. long, tipped with the short curved style.

CLITORIA ZANZIBARENSIS, *Vatke in Œster. Bot. Zeitschrift*, 1878, p. 261.—Baron's 4586 and 4615 quite agree with Hildebrandt's 1189 from Zanzibar, on which this is founded. It seems to me only a variety of *C. heterophylla*, Lam., receding from the type by its lanceolate or oblong-lanceolate leaflets 1–1$\frac{1}{2}$ in. long, and larger flowers.

MUCUNA (§ STIZOLOBIUM) AXILLARIS, n. sp.

Herbacea, volubilis, ramulis tenuibus pilosis, foliis longe petiolatis membranaceis facie tenuiter dorso dense adpresse hispidulis, floribus paucis axillaribus fasciculatis brevissime pedicellatis, calycis pilosi tubo campanulato dentibus ovatis acutis tubo æquilongis, vexillo petalis reliquis duplo breviori, legumine cylindrico exalato dense persistenter hispidulo-velutino.

A herbaceous climber, with very slender densely pilose stems. Stipules minute, lanceolate; petiole 1$\frac{1}{2}$–2 in. long; leaflets 2–3 in. long; end one oblong; stipellæ minute. Flowers in nearly sessile fascicles in the axils of the leaves. Calyx $\frac{1}{4}$ in. long, very silky; tubes broadly campanulate; teeth deltoid or lanceolate. Corolla above an inch long; petals all obtuse. Pod curved, 1$\frac{1}{2}$ in. long, $\frac{1}{3}$ in. in diam., clothed with spreading grey bristles.—*Baron* 4877! Native name *Agy*. Allied to *M. pruriens*, DC.

RHYNCHOSIA TRICHOCEPHALA, n. sp.

Volubilis, ramulis dense pilosis, foliis longe petiolatis trifoliolatis subcoriaceis facie parce dorso dense pilosis, foliolo terminali cordato-ovato, racemis densis axillaribus et terminalibus, bracteis magnis ovatis dense pilosis, pedicellis calyci æquilongis, calycis pilosi tubo campanulato dentibus lanceolatis, petalis conspicue venosis calyce duplo longioribus, ovario dense piloso.

A climber, with slender terete woody densely pilose branchlets. Stipules scariose, lanceolate; petiole 1–1$\frac{1}{2}$ in. long; leaflets 2–3 in. long, acute, shallowly cordate, green and slightly hairy above, persistently pubescent beneath. Racemes copious, few-flowered, dense; bracts ovate acuminate, $\frac{1}{4}$ in. long. Calyx pilose, $\frac{1}{6}$ in. long; teeth all acute. Corolla $\frac{1}{3}$ in. long; petals conspicuously veined with reddish brown on a yellowish ground. Stamens and style abruptly up-curved.—*Baron* 3393! Near *R. viscosa*, DC.

DALBERGIA SCORPIOIDES, n. sp.

D. ramulis gracilibus glabris, foliis petiolatis imparipinnatis firmis glabris, foliolis 9–11 oblongis alternis petiolulatis, floribus copiose paniculatis, paniculæ ramis scorpioideis, pedicellis subnullis, bracteis late ovatis persistentibus, calyce tubo infundibulari dentibus tubo vix æquilongis, petalis calyce duplo longioribus, staminibus isadelphis, ovario piloso.

An erect shrub or tree, with glabrous branchlets and leaves. Leaves 3–6 in. long, including the 1–1½ in. petiole; leaflets 1–1½ in. long, the upper larger and oblong, the lower shorter and suborbicular; petiolules $\frac{1}{12}$ in. long. Flowers in copious terminal panicles with scorpioid pubescent branchlets. Calyx $\frac{1}{12}$ in. long, with a pair of small persistent ovate obtuse bracts clasping its base; teeth obtuse. Petals obtuse, twice as long as the calyx. Stamens in two bundles of 5 each, nearly as long as the petals.—*Baron* 4583!

DALBERGIA POOLII, n. sp.

D. ramulis validis glabris, foliis longe petiolatis firmis glabris lucidis, foliolis 5–7 alternis longe petiolulatis oblongis vel ovatis, floribus dense corymboso-paniculatis, paniculæ ramulis pilosis, pedicellis brevibus, calyce glabro tubo campanulato glabro dentibus difformibus, petalis calyce duplo longioribus, staminibus monadelphis.

A tree, glabrous in all its parts. Leaves 4–6 in. long, including the 1–1½ in. petiole; end leaflet 2–3 in. long; lower shorter, ovate, acute; petiolules $\frac{1}{6}$–$\frac{1}{4}$ in. long. Panicles terminal; lower branches from the axils of large leaves. Calyx $\frac{1}{12}$ in. long; lower teeth as long as the tube; upper semiorbicular, much shorter. Corolla $\frac{1}{6}$ in. long; standard orbicular. Stamens 10, monadelphous. Ovary hairy along the upper suture. Fruit not seen.—*Baron* 4393! Mr. Pool brought us in 1876 four different kinds of Voamboana timber, from one of which, he says, handsome furniture is manufactured. The present species is allied to the Indian *D. latifolia*, Roxb.

LONCHOCARPUS PAULLINIOIDES, n. sp.

Sarmentosus, ramulis gracilibus teretibus glabris, foliis longe petiolatis trifoliolatis glabris, foliolis oblongis acutis, racemis elongatis laxis, floribus fasciculatis, pedicellis brevibus, bracteolis ovatis obtusis persistentibus, calyce sericeo tubo campanulato dentibus brevibus obtusis, petalis latis rubellis calyce 3–4plo longioribus, legumine lineari villoso.

A scandent shrub, with slender terete woody branchlets. Petiole 1–2½ in. long; leaflets shortly stalked, the end one the largest, 2–4 in. long, moderately firm in texture, green and gla-

brous on both surfaces. Flowers in lax racemes and also in fascicles from the axils of the leaves; pedicels unequal, sometimes $\frac{1}{4}$–$\frac{1}{3}$ in. long. Calyx $\frac{1}{6}$ in. long, with a pair of ovate persistent bracteoles at the base; teeth obtuse, much shorter than the tube. Petals silky, $\frac{1}{2}$–$\frac{3}{4}$ in. long. Pod straight, linear, densely deltoid, with short persistent brown pubescence.—*Baron* 4748! 4828! 4807! 4863! 4853!

DICHROSTACHYS UNIJUGA, n. sp.

Fruticosa, ramulis gracilibus lignosis, stipulis ovatis scariosis striatis, foliis breviter petiolatis, pinnis unijugis, foliolis 10–25-jugis parvis confertis rigidulis inæquilateraliter lineari-oblongis obtusis, floribus in capitulis oblongis axillaribus breviter pedunculatis aggregatis, superioribus densioribus staminibus antheriferis, calyce sessili obconico segmentis ovatis, petalis oblongo-lanceolatis.

A shrub, with long slender woody glabrous branchlets. Pinnæ 1–1$\frac{1}{2}$ in. long, erecto-patent; rhachis slender, pubescent; leaflets deciduous, $\frac{1}{6}$ in. long, green and glabrous on both surfaces, produced at the base on the lower side. Heads $\frac{1}{2}$ in. in diam., on short peduncles from the axils of the leaves. Corolla $\frac{1}{2}$ line long, three times as long as the calyx. Staminodes reddish, protruded $\frac{3}{8}$–$\frac{1}{2}$ in. beyond the tips of the lower flowers. Pod not seen.—*Baron* 4602! 4758! 4765!

PIPTADENIA LEPTOCLADA, n. sp.

Fruticosa, inermis, glabra, ramulis gracillimis, foliis bipinnatis, petiolo glandula magna ad apicem prædito, pinnis 12–18-jugis, foliolis multijugis rigidulis parvis oblongo-lanceolatis confertis, floribus pentameris in capitulis oblongis axillaribus breviter pedunculatis aggregatis, calyce basi bracteato tubo infundibulari dentibus deltoideis, petalis lanceolatis luteis, staminibus longe exsertis.

A shrub, glabrous in all its parts, with long slender branchlets. Leaves 2–3 in. long, including the $\frac{1}{2}$ in. petiole, which bears a large conical brown gland on one side at the top; pinnæ $\frac{1}{2}$ in. long; leaflets $\frac{1}{12}$ in. long, crowded, firm in texture, bright green. Heads solitary from the axils of the upper leaves, on short erecto-patent peduncles, $\frac{1}{4}$ in. in diam. Petals $\frac{1}{12}$ in. long. Stamens twice as long as the petals. Legume not seen.—*Baron* 4730!

MIMOSA MYRIOCEPHALA, n. sp.

Fruticosa, ramulis validis angulatis glabris cum foliorum rhachibus aculeis copiosis uncinatis parvis stramineis armatis, foliis bipinnatis, pinnis 10–12-jugis, foliolis multijugis inæquilateraliter oblongis rigidulis obscure ciliatis

basi postice productis, floribus tetrameris in capitula parva globosa pedunculatis copiose paniculatis dispositis, calyce glabro tubo infundibulari dentibus parvis deltoideis, petalis oblongis, legumine tenui curvato glabro inermi 6–8-spermo.

A shrub, with stout strongly angled branchlets, armed, like the leaf-rhachides, with copious small toothed prickles. Leaves sometimes a foot long; pinnæ 2–3 in. long; leaflets firm in texture, obtuse, imbricated, $\frac{1}{3}$–$\frac{1}{2}$ in. long. Panicle a foot or more long, the lower branches produced from the axils of large leaves; heads globose, $\frac{1}{3}$ in. in diam. Stamens yellow, much exserted. Legume 3 in. long, $\frac{1}{2}$ in. broad.—*Baron* 990! 2096! 3410! 4700. Near *M. latispinosa.*

Acacia xiphoclada, n. sp.

Arborea, ramosissima, glabra, ramulis angulatis, foliis propriis bipinnatis, pinnis 5–6-jugis, foliolis multijugis parvis oblongis confertis, phyllodiis rigidulis lanceolatis subsessilibus, floribus in capitula parva axillaria globosa breviter pedunculatis aggregatis, calyce obconico vix dentato, corollæ segmentis luteis oblongo-lanceolatis, staminibus breviter exsertis, legumine ignoto.

A much-branched tree, glabrous in all its parts. Proper leaves apparently only produced when it is young, 3 in. long, including the short petiole, with pinnæ under an inch long, with very numerous small crowded leaflets. Phyllodia rigidly coriaceous, flat, simple, 2–4 in. long, $\frac{1}{4}$–$\frac{1}{2}$ in. broad at the middle, vertically ribbed, narrowed gradually to the base and apex. Heads globose, $\frac{1}{6}$ in. in diam., produced in the axils of the phyllodes on short erecto-patent pedicels. Flowers 20–30 to a head. Calyx $\frac{1}{3}$ in. long. Pod not seen.—*Baron* 1695! 4384! Closely allied to *A. heterophylla*, Willd., of Mauritius.

Albizzia trichopetala, n. sp.

Fruticosa, ramulis pubescentibus, petiolo medio glandulifero, pinnis 5–6-jugis, foliolis 10–20-jugis parvis oblongo-rhomboideis confertis facie glabris viridibus dorso albidis pilosis, floribus in capitula glabra axillaria pedunculatis aggregatis dispositis, pedicellis pilosis flori æquilongis, calyce piloso segmentis parvis deltoideis, corollæ pilosæ dentibus ovatis, tubo staminali petalis breviori, ovario lineari glabro.

An erect shrub or tree, with slender pilose branchlets. Petiole 1–1$\frac{1}{2}$ in. long, with a single large gland at the middle; blade 3–4 in. long; upper pinnæ 2 in. long; lower shorter, with fewer leaflets; leaflets $\frac{1}{6}$ in. long. Heads 1$\frac{1}{2}$ in. in diam., produced singly in the axils of the upper leaves on slender erecto-patent

peduncles 2 in. long. Calyx $\frac{1}{16}$ in. long. Corolla $\frac{1}{6}$ in. long, densely pilose. Stamens protruded $\frac{3}{4}$ in. beyond the corolla. Legume not seen.—*Baron* 4644! Near the Cape *A. Forbesii*, Benth.

PARINARIUM EMIRNENSE, n. sp.

P. ramulis gracilibus apice pubescentibus, foliis breviter petiolatis obovato-oblongis obtusis subcoriaceis lucidis glabris, floribus laxe corymboso-paniculatis, ramulis pubescentibus, pedicellis brevibus, sepalis ovatis tomentosis, petalis oblongis unguiculatis, ovario globoso obliquo tomentoso, stylis 2 glabris ovario æquilongis.

An erect shrub or tree, with slender branchlets. Petiole $\frac{1}{8}$–$\frac{1}{6}$ in. long; blade 2–3 in. long, 1–1$\frac{1}{2}$ in. broad, green and glabrous on both surfaces, with 5–6 pairs of arcuate raised main veins beneath. Panicles both axillary and terminal; branchlets and pedicels grey-tomentose. Calyx $\frac{1}{8}$ in. long. Petals dark purple. Ovary globose, densely pubescent, seated obliquely on the base of the calyx.—*Baron* 3672!

WEINMANNIA LEPTOSTACHYA, n. sp.

Fruticosa, ramulis gracilibus pubescentibus, foliis distincte petiolatis imparipinnatis rigidulis glabris venis exsculptis, foliolis 7–9 oblongis obtusis inciso-crenatis, floribus parvis pentameris spicatis, calycis tubo campanulato segmentis ovatis, petalis oblongis calyce duplo longioribus, staminibus inclusis, ovario hispido.

A shrub, with slender terete copiously lenticellate purplish branchlets, pubescent towards the tip. Leaves 2–3 in. long including the $\frac{1}{3}$–$\frac{1}{2}$-in. petiole; rhachis winged between the leaflets, which are $\frac{1}{2}$–1 in. long. Flowers arranged in copious slender spikes 2–3 in. long, with a pubescent rhachis. Calyx slightly hairy, $\frac{1}{3}$ line long. Petals obtuse, twice as long as the calyx. Stamens shorter than the petals. Fruit not seen.—*Baron* 4434!

CRASSULA FRAGILIS, n. sp.

Annua, fragilis, pubescens, caulibus gracillimis dichotomiter furcatis, foliis sessilibus oblongo-spathulatis acutis, floribus pentameris solitariis pedicellis filiformibus elongatis, calyce campanulato piloso tubo brevissimo segmentis lanceolatis, petalis rubris oblongis calyci paulo superantibus, genitalibus calyci æquilongis.

A fragile annual, with erect dichotomously forked pubescent stems not more than an inch long. Leaves crowded, opposite, fleshy, $\frac{1}{6}$ in. long, narrowed from above the middle to the base. Flowers solitary, on terminal hairy pedicels $\frac{1}{8}$ in. long. Calyx

$\frac{1}{12}$ in. long. Petals reddish, oblong, a little longer than the calyx. Anthers small, red, globose. Carpels as long as the petals; style short.—*Baron* 3348! Belongs to the section *Filipedes*, as defined in 'Flora Capensis.'

KALANCHOE BREVICAULIS, n. sp.

Perennis, glabra, caulibus brevibus flexuosis, foliis parvis confertis sessilibus carnosis obovato-cuneatis obtusis dimidio superiori serratis, pedunculo stricto brevi, floribus multis in paniculam terminalem modice densam dispositis, pedicellis flore interdum æquilongis, calyce haud laxo tubo brevi dentibus lanceolato-deltoideis acutis. corollæ rubellæ tubo infundibulari segmentis oblongis acutis tubo æquilongis, stylis brevibus.

A fleshy erect perennial, with tortuose branching stem under half a foot long. Leaves crowded towards the top of the stems, ascending, decussate, $\frac{3}{4}$–1 in. long, cuneate and entire in the lower half. Peduncle slender, naked, erect, 2–3 in. long. Panicle 1–2 in. in diam., dichotomous; branches and pedicels slender, glabrous; lower $\frac{1}{2}$ in. long. Flowers tetramerous, reddish. Calyx $\frac{1}{3}$ in. long. Corolla $\frac{1}{2}$ in. long. Stamens reaching halfway up the corolla-segments. Ovaries narrowed gradually into the short styles.—*Baron* 3542! Near *K. pumila*, Baker in Journ. Linn. Soc. xx. p. 139, which is the same as *K. multiceps*, Baill. in Bull. Linn. Soc. Par. 489, and Hildebrandt's 3576.

KALANCHOE BRACHYCALYX, n. sp.

Perennis (foliis ignotis), pedunculo elongato, floribus permultis in paniculam densam corymbosam dispositis, paniculæ ramis pubescentibus, pedicellis brevibus, calyce stricto tubo pubescente campanulato, dentibus latis brevissimis, corollæ rubræ pubescentis tubo oblongo-cylindrico segmentis parvis oblongis, stylis brevibus.

A perennial, with elongated erect flower-stems, ending in dense corymbose panicles, with flowers, pedicels, and branches all covered with short drab pubescence. Pedicels at most as long as the calyx. Calyx $\frac{1}{12}$ in. long and broad. Corolla $\frac{1}{4}$ in. long; tube $\frac{1}{12}$ in. in diam.; segments oblong, acute, $\frac{1}{4}$ as long as the tube. Stamens and style protruded from the throat of the corolla-tube. Ovaries glabrous, nearly as long as the corolla-tube.—*Baron* 4319!

KALANCHOE PUBESCENS, n. sp.

Perennis, caule valido elongato pubescente, foliis petiolatis orbicularibus crenatis carnosis, pedunculo elongato, floribus multis in paniculam corymbosam dispositis, paniculæ ramis pubescentibus, pedicellis flori interdum æquilongis, calyce pubescente haud inflato tubo campanulato dentibus

deltoideis, corollæ tubo infundibulari segmentis parvis oblongis, stylo ovario æquilongo.

A robust erect perennial, with pubescent erect flowering-stems 2 feet long. Leaves in distant pairs, with a petiole as long as the blade, which is 2 in. long and broad. Panicle half a foot broad, with erecto-patent main branches; pedicels sometimes $\frac{1}{2}$ in. long. Calyx $\frac{1}{6}$ in. long and broad; segments as long as the tube. Corolla $\frac{5}{8}$ in. long. Stamens reaching out of the corolla-tube.—*Baron* 3574!

KALANCHOE GOMPHOPHYLLA, n. sp.

Perennis, glabra, caulibus brevibus, foliis obovato-cuneatis sessilibus subintegris, pedunculo elongato, floribus parvis permultis in paniculam thyrsoideam ramis corymbosis dispositis, pedicellis flore brevioribus, calyce campanulato tubo brevissimo segmentis deltoideis, corollæ luteæ tubo ovoideo segmentis parvis ovatis, stylis brevibus.

An erect perennial, with flowering-stems about a foot long. Lower leaves an inch long, arranged in decussate pairs, very obtuse, cuneate in the lower half. Panicle of several dense corymbs; main branches erecto-patent, the lower subtended at the base by small leaves. Calyx $\frac{1}{16}$ in. long. Corolla $\frac{1}{6}$ in. long, the tube $\frac{1}{12}$ in. in diam.; segments $\frac{1}{3}$–$\frac{1}{4}$ as long as the tube. Stamens and style just exserted from the corolla-tube.—*Baron* 3543! Nearly allied to *K. Hildebrandtii*, Baill.

KALANCHOE INTEGRIFOLIA, n. sp.

Perennis, glabra, caule brevi, foliis crassis sessilibus oblongo-cuneatis obtusis integris, pedunculo stricto nudo elongato, floribus pro genere parvis in paniculam densam cymosam dispositis, ramis pubescentibus, pedicellis brevibus, calyce stricto parvo tubo brevissimo segmentis ovatis, corollæ segmentis oblongis tubo ovoideo æquilongis, stylis brevibus.

A perennial, with stiffly erect flowering-stems under a foot long. Leaves crowded, glabrous, very thick, $1\frac{1}{2}$ in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad, narrowed gradually to the sessile base from above the middle. Peduncle naked, stiffly erect, 6–7 in. long. Panicle dichotomously branched, very dense, $1\frac{1}{2}$–2 in. in diam.; pedicels $\frac{1}{12}$–$\frac{1}{6}$ in. long. Calyx $\frac{1}{8}$ in. in diam., $\frac{1}{12}$ in. long. Corolla dull reddish, $\frac{1}{3}$ in. long. Stamens reaching halfway up the perianth-segments. Style as long as the ovary.—*Baron* 4377!

KALANCHOE (KITCHINGIA) SULPHUREA, n. sp.

Perennis, glabra, foliis caulinis sessilibus oblongis obtusis carnosis, floribus paucis laxe cymosis, pedicellis elongatis cernuis, calyce laxo tubo

campanulato dentibus deltoideis tubo æquilongis, corollæ luteæ tubo cylindrico, segmentis latis brevibus, stylis elongatis.

A perennial, glabrous in all its parts. Leaves thick, fleshy, sessile, oblong, entire. Cymes lax, few-flowered; pedicels very slender, cernuous, $\frac{1}{2}$–$\frac{3}{4}$ in. long. Calyx $\frac{1}{4}$ in. long. Corolla an inch long, with a cylindrical tube $\frac{1}{6}$ in. in diam., and 4 short segments as broad as long. Stamens reaching halfway up the corolla-segments. Ovaries cylindrical, narrowed gradually in a style $\frac{1}{2}$ in. long.—*Baron* 4180!

KALANCHOE (KITCHINGIA) STREPTANTHA, n. sp.

Perennis, robusta, glabra, foliis magnis sessilibus carnosis oblongo-spathulatis acutis, pedunculo nudo elongato, floribus multis in paniculam ramis corymbosis dispositis, pedicellis brevibus, calyce laxo magno tubo oblongo, segmentis deltoideis, corollæ luteæ tubo infundibulari medio constricto, segmentis ovatis, stylis elongatis.

An erect perennial, with a leafy stem half a foot long. Leaves in contiguous sessile decussate pairs, 5–6 in. long, $1\frac{1}{2}$–2 in. broad at the middle, entire, acute, thick and fleshy in texture, narrowed gradually from the middle to a broad base. Peduncle naked, stiffly erect, a foot long. Panicle 4–5 in. broad; pedicels $\frac{1}{4}$–$\frac{1}{2}$ in. long. Calyx $\frac{5}{8}$–$\frac{3}{4}$ in. long; teeth $\frac{1}{3}$ as long as the tube. Corolla pale yellow, $1\frac{1}{2}$ in. long; expanded limb $\frac{1}{2}$ in. in diam. Stamens reaching halfway up the perianth-segments. Style above $\frac{1}{2}$ in. long.—*Baron* 4874!

KALANCHOE (KITCHINGIA) LAXIFLORA, n. sp.

Perennis, glabra, foliis oblongis obtusis carnosis crenatis, caule elongato, floribus in paniculam laxam corymbosam dispositis, paniculæ ramis primariis elongatis ascendentibus, pedicellis flexuosis elongatis cernuis, calyce laxo membranaceo rubello tubo campanulato dentibus deltoideis, corollæ luteæ tubo medio constricto, segmentis parvis ovatis, stylis elongatis.

A perennial, glabrous in all its parts, with flowering-stems 2–3 feet long. Petiole slender, an inch long; blade $1\frac{1}{2}$–2 in. long, conspicuously crenate. Panicle a foot long, with 3 main branches, each several times dichotomously forked; pedicels very slender, $\frac{1}{2}$–$\frac{3}{4}$ in. long. Calyx $\frac{1}{3}$ in. long. Corolla pale yellow, twice as long as the calyx, ampullæform at the base, and the tube dilated again above the middle; segments as broad as long. Stamens as long as the corolla-tube. Styles $\frac{1}{4}$ in. long.—*Baron* 4306!

KALANCHOE (KITCHINGIA) SUBPELTATA, n. sp.

Perennis, glabra, caule elongato, foliis dissitis patulis longe petiolatis

ovatis obtusis crenatis petiolo supra basin insertis, pedunculo elongato, floribus paucis in paniculam corymbosam dispositis, pedicellis elongatis flexuosis, calyce laxo late campanulato dentibus late deltoideis cuspidatis, corollæ rubræ tubo ampullæformi medio constricto segmentis brevibus ovatis, stylis elongatis.

A glabrous fleshy perennial with elongated flowering-stems. Leaves opposite, in distant spreading pairs, which grow gradually smaller upwards; petiole patent, dilated at the base, lower above an inch long; blade $1\frac{1}{2}$–2 in. long, truncate or slightly cordate at the base, crenate all round the margin. Panicle 4–5 in. in diam.; main branches arcuate; flowers in fascicles, subtended by minute bracts; pedicels $\frac{1}{2}$ in. long. Calyx broadly campanulate, $\frac{1}{3}$ in. in diam. Corolla bright red, above an inch long. Stamens and styles reaching to the throat of the corolla-tube. —*Baron* 3429! Near *Kitchingia miniata*, Baker.

Dicoryphe retusa, n. sp.

D. ramulis gracilibus sursum parce lepidotis, stipulis parvis deciduis, foliis breviter petiolatis oblongis rigide coriaceis glabris obtusis vel retusis, floribus 2–4 in capitula terminalia breviter pedunculatis aggregatis, bracteis minutis, calycis tubo infundibulari dense lepidoto, segmentis ovatis tubo triplo brevioribus, petalis purpurascentibus patulis, fructu scabro infra medium bifido.

A much-branched erect shrub or small tree. Petiole $\frac{1}{12}$–$\frac{1}{6}$ in.; blade $1\frac{1}{2}$–3 in. long, $\frac{1}{2}$–$1\frac{1}{4}$ in. broad, firm in texture, green and glabrous on both surfaces, the main veins of the underside fine and indistinct; stipules oblanceolate, $\frac{1}{6}$ in. long, similar in texture to the leaves. Peduncle very short. Flower-calyx $\frac{1}{3}$ in. long, plicate in the lower third of the tube, clothed with brown lepidote indumentum. Petals dark purple, obtuse, protruded $\frac{1}{6}$ in. beyond the calyx. Anthers exserted a little from the calyx. Fruit $\frac{1}{2}$ in. long, with a short pedicel, and protruded $\frac{1}{8}$ in. beyond the enveloping base of the calyx.—*Baron* 4408!

Dicoryphe guatteriæfolia, n. sp.

D. ramulis gracilibus sursum parce lepidotis, stipulis parvis lanceolatis, foliis breviter petiolatis ovatis vel oblongis obtusis rigide coriaceis utrinque viridibus glabris, floribus 3–4 in capitula terminalia breviter pedunculatis aggregatis, bracteis parvis linearibus, calycis tubo oblongo dense lepidoto segmentis ovatis tubo 3–4plo brevioribus, petalis oblongis, ovario tomentoso.

An erect shrub or small tree, with slender branchlets, thinly lepidote towards the tip. Stipules $\frac{1}{8}$ in. long; petiole $\frac{1}{6}$–$\frac{1}{4}$ in.;

blade $1\frac{1}{2}$–2 in. long, rounded at the base, subcoriaceous, with 7–8 pairs of slightly raised erecto-patent main veins joined by arches a space from the edge. Flowers tetramerous, in shortly-peduncled terminal clusters. Calyx $\frac{1}{4}$ in. long, the tube plicated in the lower third. Petals produced $\frac{1}{6}$ in. beyond the calyx. Ovary protruded a little from the persistent plicate base of the calyx. Bracts persistent, $\frac{1}{12}$–$\frac{1}{8}$ in. long.—*Baron* 4940 !

DICORYPHE LAURIFOLIA, n. sp.

D. ramulis gracilibus glabris, stipulis parvis caducis, foliis breviter petiolatis oblongis rigide coriaceis glabris obtusis vel emarginatis, floribus circiter 3 in capitula terminalia breviter pedunculatis dispositis, fructu bifido valvis apice protrusis.

An erect much-branched shrub or tree, with slender branchlets. Petiole $\frac{1}{12}$–$\frac{1}{6}$ in. long; blade 2–3 in. long, $1\frac{1}{4}$–$1\frac{3}{4}$ in. broad at the middle, deltoid at the base, green and glabrous on both sides, the main veins fine and inconspicuous beneath. Flowers about 3 in peduncled terminal heads. Calyx and corolla not seen. Fruits ovoid, $\frac{3}{4}$ in. long, smooth, with two divergent valves protruded $\frac{1}{6}$ in. beyond the persistent base of the calyx, shortly pedicellate.—*Baron* 4941 !

CALOPYXIS MALIFOLIA, n. sp.

C. ramulis gracilibus apice solum ferrugineo-pubescentibus, foliis petiolatis orbicularibus vel oblongis acutis utrinque glabris, racemis densis brevibus terminalibus, ovario breviter stipitato piloso, calycis limbo cuneato-infundibulari glabro dentibus 5 deltoideis, staminibus breviter exsertis.

An erect shrub, with slender woody branchlets, pubescent only towards the tip. Leaves $1\frac{1}{2}$–2 in. long, moderately firm in texture, green and glabrous on both surfaces; petiole $\frac{1}{4}$–$\frac{1}{3}$ in. long. Racemes dense, 1–$1\frac{1}{2}$ in. long; rhachis pubescent. Ovary pilose, $\frac{1}{6}$ in. long. Calyx glabrous, $\frac{1}{3}$ in. long; teeth spreading or reflexing. Stamens exserted a little beyond the calyx-teeth; anthers small, ovoid, apiculate.—*Baron* 4709 ! 4846 ! 4847 !

EUGENIA (§ JOSSINIA) OLIGANTHA, n. sp.

E. ramulis gracilibus obscure pubescentibus, foliis petiolatis oblongis acutis basi deltoideis subcoriaceis utrinque viridibus venis obscuris, floribus paucis axillaribus, pedicellis flore longioribus, calycis tubo turbinato, segmentis 4 oblongis obtusis inæqualibus, petalis patulis obovato-cuneatis, staminibus petalis brevioribus.

A much-branched erect shrub or tree. Leaves 2–3 in. long, about an inch broad at the middle, narrowed to both ends, firm

in texture, green and glabrous on both surfaces; petiole $\frac{1}{6}$-$\frac{1}{4}$ in. long. Flowers produced only from the axils of the upper leaves; pedicels $\frac{1}{4}$-$\frac{1}{3}$ in. long. Calyx-limb $\frac{1}{12}$ in. long. Expanded corolla $\frac{1}{4}$ in. in diam. Stamens as long as the calyx-limb.—*Baron* 3743!

EUGENIA (§ SYZYGIUM) AGGREGATA, n. sp.

Ramosissima, glabra, foliis petiolatis oblongis obtuse cuspidatis rigide coriaceis utrinque viridibus venulis omnibus crebris exsculptis, floribus parvis dense corymboso-paniculatis, pedicellis brevissimis, calycis tubo obconico glabro nitido dentibus latis brevibus, petalis cohærentibus, staminibus permultis calyce longioribus.

A much-branched erect tree, glabrous in all its parts. Petiole $\frac{1}{6}$-$\frac{1}{4}$ in. long; blade $1\frac{1}{2}$-2 in. long, narrowed to an obtuse point, cuneate at the base, thick and rigid, with all the veinlets on both sides raised. Flowers very numerous, arranged in dense terminal corymbose panicles. Calyx $\frac{1}{6}$ in. in diam. Corolla-bud semiorbicular. Stamens $\frac{1}{6}$ in. long.—*Baron* 1115! 4321! 4917! 4939! Near *E. tanalensis*, Baker.

RHODOSEPALA, genus novum Melastomacearum tribus Osbeckieæ.

Calyx setosus, tubo campanulato, segmentis 5 ovatis membranaceis saturate rubris deciduis, dentibus setiferis persistentibus alternantibus. Petala 5, orbiculari-cuneata, purpurea. Stamina 10, æqualia, antheris leviter undulatis apice poro unico dehiscentibus connectivo haud producto basi antice bicalcarato. Ovarium globosum, immersum, ovulis in loculo permultis; stylus elongatus subulatus sursum curvatus apice stigmatosus. Capsula membranacea in calycis tubo perfecte immersa, dimidio superiori libera. Semina cochleata minutissima copiosa.

Allied to *Antherotoma* and *Dionychia*.

RHODOSEPALA PAUCIFLORA, *Baker*. Species sola.

Stems slender, herbaceous, spreading, sparsely bristly, unbranched below the inflorescence. Leaves few, opposite, shortly petioled, oblong, obtuse, distinctly triplinerved, $\frac{3}{4}$-1 in. long, thinly bristly and green on both surfaces, moderately firm in texture. Flowers few, sometimes one only, arranged in lax terminal cymes, the lower branches from the axils of the upper leaves. Calyx-tube $\frac{1}{6}$ in. long and broad, thinly beset with spreading whitish bristles, subtended at the base with a pair of ovate obtuse dark purple deciduous bracteoles; segments ovate, bright red, $\frac{1}{12}$ in. long. Petals $\frac{1}{4}$-$\frac{1}{3}$ in. broad. Stamens as long

as the petals; anthers $\frac{1}{6}$ in. long, bright yellow, with a pair of small curved spurs from the base of the connective; filament nearly as long as the anther. Style finally $\frac{1}{2}$ in. long.—*Baron* 4909!

AMPHOROCALYX, genus novum Melastomacearum tribus Oxysporeæ.

Calyx glaber, urceolatus, tubo verticaliter multistriatus, ore dentibus 4 brevissimis subdeltoideis instructo. Petala 4, oblongo-unguiculata. Stamina 8, æqualia, antheris rectis apice 1-porosis, connectivo basi breviter producto postice bicalcarato, filamentis brevibus deorsum applanatis. Ovarium 4-loculare, in tubo profunde immersum, ovulis permultis; stylus elongatus, filiformis, sursum curvatus, apice stigmatosus. Fructus inferus indehiscens 4-locularis, seminibus permultis cuneatis.

Allied to *Veprecella* and *Rousseauxia*.

AMPHOROCALYX MULTIFLORUS, *Baker*. Species sola.

An erect shrub, with glabrous woody rather stout quadrangular stems. Leaves opposite, cordate-ovate, acute, 3–5 in. long, 2–3 in. broad, moderately firm in texture, distinctly triplinerved, with a few bristles on the surface above and on the main ribs below. Flowers in lax terminal panicles 4–5 in. long and broad, with cymose branches, the lower subtended at the base by reduced stalked leaves; pedicels short. Calyx-tube $\frac{1}{6}$ in. long and broad, constricted to a distinct neck $\frac{1}{12}$ in. in diam.; vertical ribs about a dozen; teeth very short. Petals deciduous, probably yellow, $\frac{1}{4}$ in. long. Anthers yellow, $\frac{1}{6}$ in. long, with a couple of spreading yellow spurs $\frac{1}{3}$–$\frac{1}{2}$ line long from the back just below the base; filament shorter than the anther. Capsule completely immersed in the calyx-tube below the neck. Seeds very numerous, very minute.—*Baron* 4889!

DICHŒTANTHERA CRASSINODIS, n. sp.

Arborea, ramulis validis glabris nodis incrassatis, foliis hysteranthiis oblongis membranaceis hispidulis, floribus tetrameris in paniculas laxas deltoidea dispositis, pedicellis elongatis erecto-patentibus supra medium articulatis, ovario globoso glabro, calycis segmentis deltoideis ciliatis, petalis purpurascentibus orbiculatis unguiculatis, staminibus 4 rubellis connectivo infra antheram longe producto, 4 luteis connectivo breviter producto.

A tree, with the flowers in lax deltoid panicles 3–4 in. long and broad, at the end of the stout woody leafless branches; pedicels erecto-patent; lower $\frac{1}{2}$–$\frac{3}{4}$ in. long; bracts lanceolate or ovate-

lanceolate. Flower-calyx $\frac{1}{6}$ in. long and broad; calyx-segments under a line long. Petals $\frac{1}{3}$ in. broad, $\frac{1}{2}$ in. long. Longer stamens as long as the petals; anthers $\frac{1}{8}$ in. long; connective produced $\frac{1}{6}$ in. below the anther, bearing 2 yellow posticous spurs; smaller anthers with the spurs a short distance below the anther. Style as long as the petals, narrowed to the base. Leaves produced after the flowers, oblong, obtuse, cuneate at the base, distinctly triplinerved, hispid, especially on the under surface.—*Baron* 4825! 4925! Mr. Baron has again gathered *D. oblongifolia*, Baker=*Baron* 3838!

VEPRECELLA BIFORMIS, n. sp.

Glabra, ramulis sterilibus longe sarmentosis, floriferis patulis, foliis breviter petiolatis oblongis obtusis triplinerviis crenatis, paniculæ laxæ ramis inferioribus cymosis paucifloris, pedicellis elongatis, calycis tubo globoso glabro limbo angusto subintegro, petalis latis lilacinis, fructu capsulari 5-valvi calyci æquilongo.

Long sterile branches climbing up trees perpendicularly or along the ground from one tree to another, bearing copious opposite oblong obtuse shortly petioled glabrous triplinerved leaves often tinged with purple. Leaves of the flowering stems longer than those of the creeping sterile shoots, 2–3 in. long. Panicle lax, terminal, $\frac{1}{2}$ ft. long; upper branches simple; lower cymose; pedicels $\frac{1}{2}$–$\frac{3}{4}$ in. long. Fruit-calyx $\frac{1}{4}$ in. diam., strongly ribbed; limb very narrow. Petals suborbicular, $\frac{1}{4}$ in. in diam. Capsule of 5 truncate valves not protruded beyond the calyx-limb. Seeds minute, cochleate.—*Baron* 1054! 3992! The sterile stems sent before by Dr. Miller, Dr. Parker, and Mr. Pool.

GRAVESIA PORPHYROVALVIS, n. sp.

Herbacea, caule gracili decumbente hispidulo apice 1–3-floro, foliis paucis longe petiolatis oblongis obtusis triplinerviis utrinque parce hispidulis, calycis tubo globoso hispidulo, limbo brevi dentibus deltoideis, fructu 5-valvi apice rubro-purpureo e calyce protruso.

Stems slender, trailing, about a foot long. Leaves about 3 to a stem; petioles ascending, densely hispid, $1\frac{1}{2}$–2 in. long; blade membranous, 1–2 in. long, slightly cordate at the base, green on both surfaces, obscurely crenulate, hispid mainly on the veins beneath and towards the margin. Pedicels $\frac{1}{2}$–$\frac{3}{4}$ in. long, densely hispid. Calyx $\frac{1}{6}$ in. in diam.; tube with 10 prominent ribs; limb very narrow. Petal and stamens not seen. Capsule with

5 rigid bright red-purple valves protruding a little beyond the calyx-limb.—*Baron* 4469!

MEDINILLA DIVARICATA, n. sp.

Fruticosa, glabra, ramulis gracilibus, foliis subsessilibus oblongo-lanceolatis acutis subcarnosis triplinerviis basi sagittatis, floribus in cymas copiosas axillares paucifloras dispositis, pedicellis elongatis gracilibus, calycis tubo globoso glabro, limbo angusto truncato, petalis orbicularibus rubellis, antheris antice bicalcaratis, postice unicalcaratis, fructu globoso carnoso magnitudine pisi.

A shrub, glabrous in all its parts, with slender terete woody branchlets. Leaves 2–3 in. long, rather fleshy, obscurely petioled, shortly auricled at the base, triplinerved, with the lateral veins springing from above the base of the midrib. Cymes peduncled, not more than half as long as the leaves; pedicels erecto-patent, $\frac{1}{3}$–$\frac{1}{2}$ in. long. Fruit-calyx $\frac{1}{6}$ in. in diam. Petals 4, $\frac{1}{8}$ in. long. Stamens 8, as long as the petals.—*Baron* 3658! Near *M. leptophylla*, Baker.

MEDINILLA LINEARIFOLIA, n. sp.

Fruticosa, glabra, ramulis gracillimis, foliis subsessilibus linearibus uninerviis subcarnosis basi sagittato-cordatis, floribus in cymas sessiles axillares paucifloras dispositis, pedicellis fructui æquilongis, fructu globoso carnoso magnitudine pisi.

A shrub, with very slender terete branchlets with swollen nodes. Leaves opposite, ascending, 3–4 in. long, $\frac{1}{6}$ in. broad, with only a single central midrib and two minute auricles at the base. Cymes sessile in the axils of the leaves; pedicels $\frac{1}{4}$ in. long, bracteolate at the middle. Petals and stamens not seen. Fruit $\frac{1}{6}$ in. in diam. —*Baron* 3844!

ROTALA CORDIFOLIA, n. sp.

R. caulibus cæspitosis simplicibus glabris, foliis ternis sessilibus cordato-orbicularibus superioribus approximatis, floribus tetrameris solitariis axillaribus sessilibus, calycis tubo campanulato demum scarioso dentibus brevibus latis cuspidatis, petalis parvis oblongis unguiculatis, ovario globoso, stylo elongato.

Stems simple, glabrous, cæspitose, 6–8 in. long. Leaves in whorls of three, $\frac{1}{6}$ in. long; lower internodes $\frac{1}{2}$ in. long; upper leaves imbricated. Flowers solitary in the axils of the leaves all down the stem. Calyx $\frac{1}{12}$ in. long and broad, 8-ribbed. Petals inserted at the throat of the calyx-tube between the teeth, $\frac{1}{24}$ in. long. Stamens inserted low down in the calyx-tube; anthers

small, oblong. Ovary ovoid; style filiform, $\frac{1}{12}$ in. long; stigma capitate. Mature fruit not seen.—*Baron* 4313!

ASTEROPEIA SPHÆROCARPA, n. sp.

Fruticosa, ramulis glabris, foliis breviter petiolatis oblanceolato-oblongis e medio ad basin sensim angustatis rigide coriaceis, floribus in paniculas densas terminales aggregatis, pedicellis brevissimis glabris, sepalis oblanceolatis obtusis rigide coriaceis, staminibus basi coalitis, fructu globoso magnitudine pisi apice trilineato.

A shrub or small tree, glabrous in all its parts. Leaves alternate, not crowded, thick and rigid, $1\frac{1}{2}$–2 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad above the middle, narrowed gradually from the middle to a short petiole. Flowers in a dense panicle $1\frac{1}{2}$ in. in diam. at the end of the branchlets; pedicels short, glabrous. Sepals brown, rigid, vertically ribbed, $\frac{1}{4}$ in. long. Petals deciduous (not seen). Stamens 10, longer than the sepals, deltoid at the base and shortly connate. Fruit brown, coriaceous, glabrous, 3-celled, $\frac{1}{6}$ in. in diam., with 3 grooves, along which it splits, radiating from its apex.—*Baron* 3401! Closely allied to *A. densiflora*, Baker in Journ. Bot. 1882, p. 19. Dr. Baillon refers the genus to Ternstrœmiaceæ, and unites with it my *Rhodoclada*.

MODECCA HEDERÆFOLIA, n. sp.

Sarmentosa, cirrhifera, ramulis gracilibus lignosis teretibus, foliis longe petiolatis membranaceis profunde trilobatis segmentis acutis, flore fœmineo solitario longe pedunculato, calycis tubo brevi campanulato segmentis 5 oblongis reflexis, petalis oblanceolatis obtusis calyce brevioribus, fructu magno oblongo-fusiformi longe stipitato.

A large copiously cirrhiferous woody climber, glabrous in all its parts. Cirrhi $\frac{1}{2}$ ft. long, woody. Petiole 2 in. long; blade 5–5 in. long and broad, deeply 3-lobed; central segment oblong, narrowed to the base. Peduncle 4–5 in. long, with a cirrhus below the solitary flower. Calyx $\frac{1}{3}$ in. long. Fruit 5–6 in. long, 2 in. in diam., narrowed gradually into a gynophore an inch long. —*Baron* 3875!

BEGONIA (§ QUADRILOBARIA) FRAGILIS, n. sp.

Acaulis, petiolis brevibus glabris, foliis cordato-orbicularibus membranaceis leviter repandis denticulatis, pedunculo stricto pedali, floribus in cymas paucifloras corymbosas monoicas dispositis, bracteis obovato-spathulatis, perianthio masculo segmentis 2 cordato-orbicularibus, filamentis brevibus liberis, ovario oblongo-triquetro alis tribus angustis inæquilatis.

A fragile annual, with a slender rootstock and very thin leaves. Petiole $\frac{3}{4}$–$1\frac{1}{2}$ in. long; leaves usually two; blade 4–6 in. broad. Peduncle $\frac{1}{2}$–1 ft. long, stiffly erect, slender, fragile. Cyme dichotomously forked, dense or rather lax; male flowers much more numerous than female. Perianth-segments reddish, $\frac{1}{3}$ in. long and broad. Anthers obtusely apiculate, $\frac{1}{8}$ in. long, three times as long as the free filaments. Ovary $\frac{1}{2}$ in. long; wings at most $\frac{1}{4}$ in. broad, confluent at the base of the ovary.—*Baron* 4677! Near *B. nossibæa*, A. DC.

Begonia Baroni, n. sp.

Perennis, glabra. caule elongato robusto ramoso, foliis magnis membranaceis inæquilateraliter cordato-orbicularibus serratis, cymis laxissimis magnis dichotomiter ramosis, fructu trialato ala unica reliquis 3–4plo latiori.

Stem smooth, straight, woody, $\frac{1}{4}$–$\frac{1}{3}$ in. in diam. Leaves 6–8 in. long and nearly as broad, green, membranous, rounded on one side at the base, deeply cordate on the other. Cymes in the fruiting stage 8–9 in. in diam. Flowers not seen. Capsule 3-celled, oblong, $\frac{3}{4}$ in. long; wings thin but firm in texture, flexible, horizontally ribbed; one wing oblong, obtuse, 1–$1\frac{1}{4}$ in. broad, the two others $\frac{1}{4}$–$\frac{1}{3}$ in. broad.—*Baron* 4353! Allied probably to *B. Lyallii*, A. DC.

Panax (§ Sphæropanax) gomphophylla, n. sp.

Arborea, glabra, foliis magnis bipinnatis foliolis obovato-cuneatis cuspidatis subcoriaceis integris, paniculæ rhachi valida bipedali, ramis simpliciter umbellatis, pedunculis brevibus arcuatis, pedicellis brevissimis apice articulatis, ovario ovoideo pentamero, stylis 5 subulatis patulis.

A tree, glabrous in all its parts. Leaves with a stout rhachis 2 feet long, with several distant pinnæ; leaflets 2–3 in. long, 1–$1\frac{1}{4}$ in. broad at the middle, firm in texture, green and glabrous on both surfaces, with the main veins beneath fine and hardly at all raised. Panicle with a stout straight woody axis 2 ft. long; peduncles slender, 1–$1\frac{1}{2}$ in. long; flowers a dozen or more in an umbel; pedicels $\frac{1}{8}$ in. long. Ovary pentagonal, glabrous, $\frac{1}{8}$ in. long, crowned by the crenate calyx-limb. Styles $\frac{1}{3}$ line long.—*Baron* 3793!

Monopetalæ.

Schismatoclada tricholarynx, n. sp.

Arborea, glabra, stipulis deltoideis, foliis oblanceolato-oblongis acutis brevissime petiolatis, floribus in cymas multifloras terminales dispositis,

calycis tubo campanulato, segmentis oblanceolatis magnis foliaceis, corollæ tubo cylindrico apice dilatato intus dense piloso, segmentis parvis ovatis, fructu clavato pæne ad basin fisso.

A much-branched tree, glabrous in all its parts. Leaves 2–3 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad above the middle, moderately firm in texture, green and glabrous on both surfaces, with fine slightly raised veins. Cymes 1–1$\frac{1}{2}$ in. broad. Calyx $\frac{1}{4}$ in. long; teeth 3–4 times as long as the tube. Corolla $\frac{1}{2}$ in. long; segments $\frac{1}{8}$ in. Capsule $\frac{1}{2}$ in. long.—*Baron* 3632! Near *S. psychotrioides*, Baker.

Danais Lyallii, n. sp.

D. ramulis pubescentibus, stipulis deltoideis, foliis breviter petiolatis obovatis subcoriaceis glabris, floribus in paniculas sparsas axillares folio multo breviores dispositis, pedicellis brevibus, bracteis parvis deltoideis, calycis tubo campanulato segmentis deltoideis, corollæ tubo brevi infundibulari segmentis oblongis tubo duplo brevioribus, fructu globoso glabro pæne ad basin fisso.

An erect shrub, with rather stout terete branchlets. Leaves 2–3 in. long, 1$\frac{1}{4}$–1$\frac{1}{2}$ in. broad, firm in texture, with 6–8 pairs of raised arcuate main veins; petiole $\frac{1}{4}$–$\frac{1}{2}$ in. Panicles erecto-patent, 1–1$\frac{1}{2}$ in. long. Calyx $\frac{1}{12}$ in. long. Corolla $\frac{1}{4}$ in. long; throat of the tube very hairy. Anthers half as long as the segments. Capsule black, $\frac{1}{6}$ in. long and broad.—*Baron* 1479! 3894! 3895! 3981! Also *Lyall* 122! *Hildebrandt* 3004! Closely allied to the Mauritian *D. fragrans*, Comm.

Danais nummularifolia, n. sp.

Fruticosa, ramulis pubescentibus, stipulis parvis deciduis, foliis breviter petiolatis parvis orbicularibus subcoriaceis utrinque viridibus glabris, floribus in paniculas sparsas terminales ramis corymbosis dispositis, pedicellis brevissimis, bracteis parvis deltoideis, calycis tubo campanulato dentibus parvis deltoideis, corollæ tubo cylindrico segmentis oblongis, staminibus segmentis æquilongis.

A much-branched shrub, with slender terete, densely shortly pubescent branchlets. Leaves about $\frac{1}{2}$ in. long and broad, firm in texture, green and glabrous on both surfaces. Cymes lax, terminal, and from the axils of the upper leaves. Calyx $\frac{1}{16}$ in. long; teeth shorter than the tube. Corolla-tube $\frac{1}{4}$ in. long; segments $\frac{1}{2}$–$\frac{1}{3}$ as long as the tube. Filaments filiform, inserted at the throat of the corolla-tube, as long as the lanceolate anthers. Fruit not seen.—*Baron* 3657! 3841! Near *D. pubescens*, Baker.

PENTAS HIRTIFLORA, n. sp.

Fruticosa, ramulis dense pilosis, stipulis fimbriatis, foliis sessilibus ovato-lanceolatis acutis facie tenuiter dorso dense pubescentibus, floribus in cymas densas terminales aggregatis, pedicellis brevissimis, bracteis linearibus, calycis tubo brevi campanulato, segmentis 5 linearibus elongatis, corollæ tubo extus piloso ore dilatato intus hirsuto, segmentis brevibus ovatis, staminibus pilosis, stylo antheris eminente.

Stems long, shrubby, densely pilose. Leaves thin in texture, dark green above, pale green beneath, 2–3 in. long, about an inch broad, with numerous parallel arcuate main veins. Cymes $1\frac{1}{2}$–2 in. broad; branches and pedicels very hairy. Calyx very hairy; segments equal, $\frac{1}{4}$ in. long. Corolla-segments $\frac{1}{8}$ in. long. Anthers inserted below the throat of the corolla-tube; filaments very short. Fruit not seen.—*Baron* 4732!

DIRICHLETIA INVOLUCRATA, n. sp.

Fruticosa, ramulis pilosis, floribus petiolatis ovatis acutis utrinque pubescentibus, floribus in capitula globosa terminalia bracteis magnis ovatis aggregatis, calyce piloso segmentis inæqualibus ovatis acuminatis foliaceis, corollæ tubo cylindrico piloso segmentis parvis oblongis, staminibus limbo æquilongis.

A shrub, with densely pubescent slender terete branchlets. Leaves 4–5 in. long, 2–$2\frac{1}{2}$ in. broad, rounded at the base, thin in texture, green on both surfaces; petiole under $\frac{1}{2}$ in. long. Peduncles pubescent, 1–$1\frac{1}{2}$ in. long; heads dense, about $\frac{1}{2}$ in. in diam.; bracts pilose; outer $\frac{1}{2}$ in. long. Calyx-segments 4, ovate-acuminate, unequal, not becoming bright red and scariose, as in the other two, the largest $\frac{1}{3}$ in. long. Corolla-tube very hairy, $\frac{3}{4}$ in. long; segments $\frac{1}{12}$ in. long. Stamens as long as the corolla-lobes. Fruit not seen.—*Baron* 3979! *Dirichletia* is united by Dr. Baillon with *Carphalea* of Jussieu, founded on a Madagascar plant.

DIRICHLETIA TERNIFOLIA, n. sp.

Arborea, stipulis tricuspidatis, foliis sessilibus ternatis oblongo-lanceolatis acutis utrinque glabris, floribus tetrameris in cymas densas terminales aggregatis, calycis segmentis rigidulis ovatis inæqualibus saturate rubris, corollæ tubo cylindrico glabro ore intus dense piloso, segmentis parvis ovatis, staminibus ex tubo subexsertis.

A tree, with woody glabrous branchlets. Leaves all in threes, 2–3 in. long, $\frac{3}{4}$–$1\frac{1}{4}$ in. broad at the middle, narrowed gradually to the base and point, moderately firm in texture, green and glabrous on both surfaces. Cymes dense, 2–3 in. in diam. Calyx-limb of 4

bright dark red segments of firm texture, the largest $\frac{1}{2}$ in. long, $\frac{1}{3}$ in. broad. Corolla-tube cylindrical, above $\frac{1}{2}$ in. long, densely pilose at the throat.—*Baron* 4280!

DIRICHLETIA TRICHOPHLEBIA, n. sp.

Arborea, ramulis pubescentibus, stipulis deltoideis pilosis, foliis oppositis sessilibus oblongis acutis basi attenuatis facie glabris dorso ad venas dense pilosis, floribus tetrameris in cymas densas terminales dispositis, calycis segmentis oblongis rubris valde inæqualibus, corollæ tubo cylindrico piloso, segmentis parvis ovatis.

A tree, with slender pubescent branchlets. Leaves $1\frac{1}{2}$–2 in. long, $\frac{3}{4}$–$1\frac{1}{2}$ in. broad at the middle, narrowed to both ends, green and glabrous above when mature, dull green beneath, very hairy on the raised veins. Flowers aggregated in dense terminal cymes 2–3 in. broad; branches pubescent; pedicels short. Calyx with 4 bright red oblong very unequal segments, connate at the base, the largest $\frac{1}{2}$–$\frac{3}{4}$ in. long. Corolla-tube $\frac{3}{4}$ in. long, dilated at the apex, the throat inside very hairy. Stamens not exserted from the corolla-tube. Style exserted beyond the corolla-segments.—*Baron* 110! 3999! 4512! 4554! Collected also by Bojer, Wykeham Perry, and Hildebrandt 3059; and may perhaps be conspecific with *Carphalea Pervilleana*, Baill. in Bull. Linn. Soc. Par. p. 188.

GARDENIA SUCCOSA, n. sp.

Glabra, copiose gummifera, ramulis gracilibus, stipulis ciliatis, foliis breviter petiolatis oblongis obtusis basi deltoideis venis primariis 7–8-jugis erecto-patentibus parallelis, floribus solitariis axillaribus breviter pedicellatis, calycis tubo brevi segmentis magnis oblanceolatis foliaceis, corollæ segmentis orbicularibus tubo infundibulari 2–3plo brevioribus, fructu globoso coriaceo glabro.

A much-branched erect shrub 8–12 feet high, glabrous in all its parts. Leaves $1\frac{1}{2}$–2 in. long, rigid in texture, lucent, quite glabrous, with 7–8 pairs of distinct parallel raised veins. Flowers solitary, on short ascending pedicels from the axils of the leaves, pentamerous. Calyx-tube $\frac{1}{8}$ in. long; segments twice as long as the tube. Corolla $\frac{1}{2}$ in. long. Fruit rigid in texture, brown, glabrous, $\frac{1}{3}$ in. long and broad, containing a dense mass of flattened seeds aggregated in a pulpy mass in each of the two cells —*Baron* 4620! 4710! Also *Hildebrandt* 3465!

PLECTRONIA MICRANTHA, n. sp.

Inermis, glabra, stipulis lanceolatis deciduis, foliis petiolatis oblongis

obtuse cuspidatis subcoriaceis venulis gracilibus immersis, floribus pentameris in cymas copiosas multifloras axillares dispositis, pedicellis flore longioribus, calyce late campanulato dentibus parvis deltoideis, corollæ tubo campanulato ore intus piloso, segmentis ovatis tubo æquilongis, antheris parvis oblongis filamentis brevissimis.

A much-branched erect tree, glabrous in all its parts. Leaves 2–3 in. long, 1–1¼ in. broad at the middle, firm in texture, glossy above, deltoid at the base. Flowers in umbels in the axils of the leaves all down the branch; pedicels ⅙ in. long. Calyx-tube ½ lin. in diam. Corolla-tube scarcely $\frac{1}{12}$ in. long. Stamens ¼ as long as the corolla-lobes. Fruit not seen.—*Baron* 3836! Near *P. buxifolia*, Baker.

IXORA PACHYPHYLLA, n. sp.

Glabra, stipulis deltoideis persistentibus, foliis breviter petiolatis lanceolatis crassis rigide coriaceis venulis gracilibus vix exsculptis, floribus parvis pentameris in paniculas densas corymbosas terminales aggregatis, pedicellis brevissimis, bracteis minutis deltoideis, calycis segmentis deltoideis tubo campanulato brevioribus, corollæ segmentis oblongis tubo infundibulari duplo brevioribus, fructu ovoideo monospermo.

A tree, with straight slender woody branchlets, glabrous in all its parts. Leaves 3–5 in. long, ¾–1 in. broad above the middle, narrowed gradually to the base, firm and thick in texture, green and glabrous on both sides, with fine inconspicuous venation. Cymes dense, terminal, level-topped, 1½–2 in. broad. Calyx $\frac{1}{12}$ in. long. Corolla ⅙ in. long. Fruit brown, ⅛–⅙ in. in diam.—*Baron* 3772!

PSYCHOTRIA (§ GRUMILEA) REDUCTA, n. sp.

Arborea, glabra, stipulis ovatis obtusis, foliis breviter petiolatis obovato-cuneatis cuspidatis subcoriaceis venis primariis parallelis exsculptis, floribus in paniculas parvas corymbosas terminales dispositis, pedicellis brevissimis, calycis tubo obconico limbo angusto dentibus brevibus latis, corollæ tubo infundibulari ore intus glabro segmentis ovatis, fructu ovoideo nigro magnitudine pisi, albumine corneo ruminato.

A much-branched erect tree, glabrous in all its parts. Stipules ovate, obtuse, large, deciduous. Leaves 1½–2 in. long, thick and rigid in texture, green and glabrous on both surfaces, with 6–8 pairs of raised parallel ribs. Calyx-tube ⅛ in. long. Corolla-tube ⅛ in. long, ⅛ in. in diam at the throat; segments ⅓ as long as the tube. Stamens just exserted from the corolla-tube. Style exserted from the corolla-tube, with two short spreading flattened branches. Drupe black, ⅙ in. diam.—*Baron* 1029! 1778! 1784!

3760! 3997! 4016! 4018! 4399! Near *P. mesentericarpa*, Baker.

Psychotria (§ Grumilea) retiphlebia, n. sp.

P. ramulis tetragonis sursum pubescentibus, stipulis ovatis, foliis vix petiolatis subcoriaceis glabris oblanceolatis obtusis vel acutis venulis faciei inferioris anastomosantibus, floribus in paniculas terminales ramulis capitatis dispositis, calycis tubo obconico piloso dentibus deltoideis, corollæ tubo infundibulari, segmentis ovatis, fructu globoso magnitudine pisi, albumine corneo ruminato.

A much-branched shrub or small tree. Leaves $1\frac{1}{4}$–$2\frac{1}{2}$ in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad above the middle, firm in texture, green and glabrous on both surfaces, with the veins beneath anastomosing in distinct areolæ. Panicles small, level-topped, terminal, with the flowers in dense clusters. Calyx $\frac{1}{16}$ in. long. Corolla $\frac{1}{6}$ in. long. Drupe $\frac{1}{6}$ in. in diam.—*Baron* 4285! 4908!

Psychotria (§ Grumilea) Parkeri, n. sp.

Arborea, glabra, stipulis deltoideis, foliis petiolatis obovato-oblongis acutis subcoriaceis utrinque viridibus glabris venis exsculptis, floribus in cymas terminales pedunculatas dispositis, ovario obconico, calycis limbo patellæformi vix dentato, corollæ tubo infundibulari, segmentis brevibus ovatis, fructu globoso magnitudine pisi, albumine corneo ruminato.

A tree 30–40 feet, glabrous in all its parts. Leaves 4–6 in. long, 2–$2\frac{1}{2}$ in. broad above the middle, firm in texture, green and glabrous on both surfaces, with numerous parallel arcuate distinctly raised main veins. Cymes level-topped, terminal, distinctly peduncled; pedicels none. Calyx $\frac{1}{8}$ in. long. Corolla $\frac{1}{4}$ in. long; expanded limb $\frac{1}{4}$ in. in diam. Drupe $\frac{1}{4}$ in. in diam.—*Baron* 1585! 3527! Also gathered in the forest of Andrangaloaka by Dr. Parker.

Gomphocalyx, genus novum Rubiacearum tribus Spermacoceæ.

Flores hermaphroditi. Calycis tubus obconicus, vittis validis; limbi dentes 7–8 deltoidei acuti patuli rigiduli. Corolla hypocrateriformis, tubo cylindrico sursum infundibulari, segmentis 5 oblongis. Stamina 5 ad tubi faucem inserta, filamentis filiformibus brevibus, antheris oblongis. Ovarium 2-loculare, ovulis in loculo solitariis; stylus filiformis, profunde bifidus, ramis falcatis. Fructus osseus indehiscens, limbo patulo coronatus.

Allied to *Hydrophylax* and *Ernodea*.

GOMPHOCALYX HERNIARIOIDES, *Baker*. Species sola.

A much-branched diffuse annual, with the habit of a large *Herniaria*, glabrous in all its parts. Stems slender, $\frac{1}{2}$–1 ft. long; branches erecto-patent. Leaves opposite, subsessile, oblong-lanceolate, acute, $\frac{1}{4}$–$\frac{3}{4}$ in. long, moderately firm in texture, 1-nerved, green and glabrous on both surfaces; stipules short, membranous, connate, persistent, slightly toothed. Flowers axillary, 1–3nate, subsessile. Flower-calyx obconic, $\frac{1}{12}$ in. long, with 7–8 teeth, each decurrent as a strong rib to the base of the tube. Corolla-tube $\frac{1}{6}$ in. long; segments $\frac{1}{3}$–$\frac{1}{4}$ as long as the tube. Stamens shorter than the corolla-segments. Style reaching to the throat of the corolla-tube, branched from halfway down. Capsule $\frac{1}{12}$ in. diam., crowned by the rigid spreading calyx-segments.—*Baron* 4585! 4782!

LECONTEA FARINOSA, n. sp.

Volubilis, ramulis gracilibus subtiliter pubescentibus, stipulis deltoideis, foliis longe petiolatis subcoriaceis cordato-ovatis acutis facie viridibus tenuiter pubescentibus dorso dense persistenter albo-incanis, cymis axillaribus longe pedunculatis foliis magnis bracteatis, bracteolis linearibus, calyce dense pubescente, tubo oblongo segmentis elongatis linearibus, fructu ovoideo compresso lucido pubescente.

A woody climber, with slender terete stems. Leaves 2–3 in. long, shallowly cordate at the base, cuspidate, densely clothed beneath with thin white tomentum; petiole an inch long. Cymes overtopping the leaves, bracteated by a pair of reduced petioled leaves. Calyx-segments $\frac{1}{3}$ in. long. Corolla not seen. Fruit $\frac{1}{2}$ in. long, crowned by the persistent calyx-segments.—*Baron* 4932!

VERNONIA STENOCLINOIDES, n. sp.

Fruticosa, ramulis albido-incanis, foliis breviter petiolatis coriaceis oblongis obtusis integris facie viridibus dorso albo-incanis, capitulis trifloris dense corymboso-paniculatis, involucro infundibulari bracteis paucis pallide brunneis adpressis scariosis, exterioribus gradatim brevioribus, achenio glabro, pappo albido flexuoso.

Branchlets very slender, woody, coated with white tomentum. Leaves 1–1$\frac{1}{4}$ in. long, firm in texture, cuneate at the base, bright green above, white beneath, with fine immersed veins. Panicle 3–4 in. long and broad; branches densely corymbose, the lower springing from the axils of large leaves. Involucre $\frac{1}{6}$ in. long; bracts few, drab; outer ovate; inner lanceolate. Corolla and pappus $\frac{1}{12}$ in. long.—*Baron* 3737!

Vernonia rhodopappa, n. sp.

Fruticosa, ramulis albido-incanis, foliis breviter petiolatis oblongis acutis integris coriaceis facie viridibus glabris dorso albo-incanis, capitulis multifloris dense corymboso-paniculatis, involucro campanulato bracteis imbricatis obtusis exterioribus dense pilosis, achenio glabro, pappo rubello.

Branchlets short, spreading, coated with thin persistent white tomentum. Leaves $1\frac{1}{2}$–2 in. long, $\frac{5}{8}$–1 in. broad, rounded at the base, firm in texture, the veins beneath fine and inconspicuous. Heads in congested corymbose panicles at the end of the short branchlets. Involucre $\frac{1}{6}$ in. long and broad; bracts firm in texture, drab, adpressed. Corolla and bright red pappus $\frac{1}{6}$ in. long. Achene only seen immature.—*Baron* 3608! Also *Hildebrandt* 3621!

Vernonia betonicæfolia, n. sp.

Herbacea, caule simplici flexuoso dense glanduloso-pubescente, foliis alternis longe petiolatis cordato-ovatis profunde crenatis utrinque viridibus pubescentibus, capitulis multifloris corymboso-paniculatis, paniculæ ramis dense glanduloso-pubescentibus, involucro campanulato glanduloso pauciseriali bracteis rigidulis exterioribus ovatis interioribus lanceolatis, achenio glabro, pappi setis albis flexuosis.

An erect herb, with green terete densely glandular-pubescent stems. Lower leaves 3–4 in. long, $1\frac{1}{2}$ in. broad, narrowed gradually to the point, deeply irregularly inciso-crenate, membranous; petiole above an inch long; upper growing gradually smaller. Heads in a lax corymbose panicle, with glandular-pubescent branches and pedicels. Involucre $\frac{1}{6}$ in. in diam.; outer bracts small, ovate; inner lanceolate, $\frac{1}{6}$ in. long. Flowers pale purple, a little exserted from the involucre. Pappus $\frac{1}{6}$ in. long. —*Baron* 4733! 4779!

Vernonia (§ Strobocalyx) capreæfolia, n. sp.

Arborea, ramulis dense pubescentibus, foliis alternis petiolatis ovatis acutis integris subcoriaceis facie scabris dorso pubescentibus venulis exsculptis, capitulis 5-floris dense corymboso-paniculatis, involucro campanulato piloso pauciseriali deciduo, bracteis exterioribus ovatis intimis oblongis, achenio glabro, pappi setis albidis flexuosis.

Branches woody, terete, densely pubescent. Leaves 2–3 in. long, $1\frac{1}{4}$–$1\frac{1}{2}$ in. broad, firm in texture, acute, broadly rounded at the base; petiole pubescent, $\frac{1}{3}$–$\frac{1}{2}$ in. long. Heads aggregated in very dense terminal corymbs 2–3 in. in diam. Involucre $\frac{1}{8}$ in. in diam., very deciduous; outer bracts small, ovate; inner oblong.

Achene 4-angled, many-ribbed, drab, glabrous, $\frac{1}{8}$ in. long. Pappus $\frac{1}{6}$ in. long.—*Baron* 3577!

VERNONIA (§ STROBOCALYX) GRISEA, n. sp.

Arborea, ramulis pubescentibus, foliis alternis petiolatis oblongis acutis dentatis subglabris utrinque viridibus, capitulis 7–8-floris copiose corymboso-paniculatis, involucro campanulato piloso bracteis pauciseriatis ovatis vel oblongis obtusis, achenio glabro, pappo albido setis exterioribus pluribus brevibus linearibus.

Branchlets woody, terete, grey, pubescent upwards. Leaves 3–4 in. long, 1–1$\frac{1}{2}$ in. broad at the middle, very acute, thin in texture, penninerved, pubescent on the midrib beneath. Panicle 4–6 in. broad; branches pubescent, the lower springing from the axils of large leaves. Involucre $\frac{1}{6}$ in. in diam.; bracts few, deciduous, brownish black; outer small, ovate; inner oblong. Corolla not seen fully developed. Pappus flexuose, $\frac{1}{6}$ in. long.—*Baron* 3437!

VERNONIA (§ STROBOCALYX) EXSERTA, n. sp.

Arborea, ramulis apice tenuiter adpresse pubescentibus, foliis alternis breviter petiolatis lanceolatis serratis utrinque viridibus glabris, capitulis 5–6-floris copiose corymboso-paniculatis, involucro campanulato bracteis pauciseriatis adpressis deciduis ovatis vel oblongis, floribus ex involucro conspicue exsertis, achenio glabro, pappo flexuoso albido setis exterioribus multis brevibus linearibus.

Branchlets woody, terete, obscurely pnbescent upwards. Leaves 3–4 in. long, under an inch broad at the middle, narrowed gradually to the acute apex and short petiole, obscurely serrulate, thin in texture. Panicle terminal, 4–6 in. broad, the lower branches springing from the axils of large leaves. Involucre $\frac{1}{8}$ in. in diam.; bracts greenish brown, rigid, slightly pubescent; outer small, ovate; inner oblong. Corolla reddish, $\frac{1}{6}$ in. long. Flowers twice as long as the involucre.—*Baron* 4364!

CONYZA SERRATIFOLIA, n. sp.

Suffruticosa, caule glabro, foliis sessilibus lanceolatis membranaceis serratis glabris, capitulis parvis copiose corymboso-paniculatis, involucro campanulato bracteis pauciseriatis lanceolatis glabris, floribus filiformibus pluribus, tubulosis paucis, achenio glabro compresso facie uninervato, pappo flexuoso albido.

An undershrub, glabrous in all its parts, with long virgate terete stems. Leaves 3–4 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad, narrowed gradually to both ends, green and glabrous on both sides. Panicle

4–5 in. long. Involucre $\frac{1}{6}$ in. in diam.; bracts moderately firm in texture, green in the middle, pale at the edge. Achene $\frac{1}{3}$ in. long. Pappus $\frac{1}{8}$ in. long.—*Baron* 4960! Closely allied, as is also *C. amplexicaulis*, to the Brazilian *C. triplinervia*, Less.

CONYZA AMPLEXICAULIS, n. sp.

Suffruticosa, caule virgato obscure piloso, foliis lanceolatis argute serratis amplexicaulibus utrinque viridibus parce pilosis, capitulis parvis multifloris copiose corymboso-paniculatis, involucro campanulato bracteis pauciseriatis subæqualibus lanceolatis glabris, floribus filiformibus multis, tubulosis paucis, achenio glabro, pappo rubello.

An undershrub, with terete green stems. Leaves 3–4 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad at the middle, narrowed gradually to both ends, thin in texture, hairy mainly on the midrib beneath. Panicle 3–4 in. broad, with branches from the axils of the upper leaves. Involucre $\frac{1}{8}$ in. in diam.; bracts glabrous, moderately firm in texture, green in the middle, pale on the edge. Achene not seen fully mature. Pappus setose, $\frac{1}{8}$ in. long.—*Baron* 4036!

CONYZA ELLISII, n. sp.

Fruticosa, ramulis gracilibus sursum obscure pubescentibus, foliis sessilibus oblanceolatis obtusis serratis glabris, capitulis parvis multifloris corymboso-paniculatis, involucro campanulato bracteis pauciseriatis subæqualibus oblongo-lanceolatis, acheniis compressis facie uninerviis, pappo flexuoso albido.

A shrub with slender brown woody terete branches. Leaves 1–1$\frac{1}{2}$ in. long, $\frac{1}{3}$–$\frac{1}{2}$ in. broad, narrowed gradually from above the middle to the base, moderately firm in texture, green and glabrous on both surfaces, penninerved, with erecto-patent main veins. Heads in small dense terminal corymbs. Involucre $\frac{1}{6}$ in. in diam.; bracts green in the middle, with pale edges. Achene glabrous, $\frac{1}{3}$ line long. Pappus $\frac{1}{8}$ in. long.—*Baron* 4676! Gathered also by Ellis and Lyall.

PSIADIA CUSPIDIFERA, n. sp.

Fruticosa, volubilis, ramulis dense breviter pilosis, foliis breviter petiolatis oblongis acutis serratis penninerviis dense pilosis, capitulis dense corymbosis, involucro campanulato piloso bracteis lanceolatis acutis adpressis viridi carinatis, achenio glabro cylindrico, pappo flexuoso pallide rubello.

A shrubby climber, with slender terete densely pilose branchlets. Leaves 1–2 in. long, $\frac{3}{4}$–1 in. broad at the middle, cuneate

at the base, not at all rigid nor viscose, green and densely pilose on both surfaces, conspicuously serrated with a little cusp to each tooth. Capitula in dense corymbs either from the tips of the branchlets or axils of the leaves. Involucre $\frac{1}{6}$ in. long and broad; bracts pauciserial, adpressed, pale green, with a dark green keel. Corolla and pappus both $\frac{1}{12}$ in. long.—*Baron* 4356! Also *Hildebrandt* 3538! from damp places in the north of Betsileo-land.

PSIADIA STENOPHYLLA, n. sp.

Fruticosa, ramosissima, glutinosa, glabra, ramulis gracilibus sulcatis, foliis subsessilibus linearibus serratis uninerviis, capitulis parvis multifloris dense corymboso-paniculatis, involucro campanulato bracteis pauciseriatis oblongis rigidulis adpressis, pappo albido flexuoso.

A shrub, with slender woody ascending branchlets. Leaves ascending, rigid in texture, $1\frac{1}{2}$–2 in. long, $\frac{1}{6}$–$\frac{1}{4}$ in. broad at the middle, narrowed gradually to both ends, minutely serrated. Heads in dense corymbs at the ends of all the branchlets. Involucre $\frac{1}{6}$ in. long and broad; bracts all greenish and obtuse, the outer small. Achene glabrous. Pappus $\frac{1}{12}$ in. long.—*Baron* 3549!

PSIADIA MODESTA, n. sp.

Fruticosa, ramulis apice breviter pubescentibus, foliis subsessilibus oblanceolatis acutis serratis subglabris, capitulis parvis multifloris corymboso-paniculatis, involucro campanulato bracteis pauciseriatis rigidulis adpressis exterioribus ovatis interioribus lanceolatis, achenio cylindrico glabro, pappi setis albis flexuosis.

A shrub, with erect terete brown calvate main branches and copious slender ascending branchlets, hairy towards the tip. Leaves erecto-patent, 1–$1\frac{1}{2}$ in. long, $\frac{1}{3}$ in. broad, moderately firm in texture, acute, penninerved, minutely serrated, not viscose. Capitula arranged in small terminal panicles with corymbose branches. Involucre glabrous, brownish, $\frac{1}{6}$ in. long and broad. Achene cylindrical, glabrous. Corolla $\frac{1}{8}$ in. long. Style-arms linear, exserted from the corolla.—*Baron* 4775!

GNAPHALIUM DIFFUSUM, n. sp.

Herbaceum, perenne, albo-lanuginosum, caulibus brevibus diffusis, foliis parvis sessilibus obovatis, capitulis paucis multifloris ad ramorum apices glomeratis, involucro campanulato bracteis pauciseriatis oblongis scariosis,

floribus filiformibus pluribus, tubulosis hermaphroditis paucis, pappo albo flexuoso.

A perennial, with densely cæspitose stems, many short and sterile, the flowering ones branched, spreading, 2–3 in. long. Leaves alternate, obovate-cuneate, $\frac{1}{2}$ in. long, persistently matted with white tomentum on both sides. Heads $\frac{1}{8}$ in. in diam., densely tomentose at the base; bracts oblong, pale brown. Achenes subcylindrical, brown, glabrous. Corolla $\frac{1}{12}$–$\frac{1}{8}$ in. long. Pappus as long as the corolla, the bristles falling singly.—*Baron* 3602!

HELICHRYSUM ARANEOSUM, n. sp.

Fruticosum, ramulis gracilibus albo-incanis, foliis petiolatis oblongis obtusis basi cuneatis facie viridibus obscure pubescentibus dorso tenuiter albido-incanis, capitulis 6–8-floris in paniculam terminalem ramis corymbosis dispositis, pedicellis brevibus albo-lanosis, involucro infundibulari bracteis multiseriatis albo-rubellis obtusis squarrosis deorsum viridi carinatis, pappo albo setoso fragili.

A shrub, with slender terete woody branchlets, clothed with white tomentum. Leaves 2–3 in. long, 1–$1\frac{1}{4}$ in. broad below the middle, moderately firm in texture, with very distinct ascending main veins. Panicle 4–5 in. in diam.; branches leafy, clothed with thick white tomentum. Involucre $\frac{1}{4}$ in. long, $\frac{1}{6}$ in. in diam., lanuginose in the lower half; bracts in many rows, outer gradually shorter. Corolla $\frac{1}{6}$ in. long. Pappus as long as the corolla.—*Baron* 4894! Nearly allied to *H. farinosum*.

HELICHRYSUM FARINOSUM, n. sp.

Fruticosum, ramulis robustis dense albo-lanuginosis, foliis breviter petiolatis subcoriaceis ovatis facie tenuiter dorso dense albo-incanis, capitulis 6–8-floris dense corymboso-paniculatis, paniculæ ramis albo-lanuginosis, pedicellis subnullis, involucro oblongo bracteis multiseriatis oblongis obtusis albo-rubellis squarrosis deorsum viridi carinatis exterioribus dorso lanuginosis, pappo albo setoso.

An erect shrub, with terete tomentose leafy branchlets $\frac{1}{8}$–$\frac{1}{6}$ in. in diam. Leaves $1\frac{1}{2}$–2 in. long, $\frac{3}{4}$–1 in. broad, densely lanuginose below, obtuse, rounded at the base, with very ascending main veins. Corymbs dense, terminal, 2–3 in. in diam. Involucre nearly $\frac{1}{4}$ in. long, $\frac{1}{8}$ in. in diam.; outer bracts gradually shorter, the inner with large reddish-white obtuse spreading tips. Corollas $\frac{1}{6}$ in. long. Pappus as long as the corolla.—*Baron* 4926!

HELICHRYSUM AMPLEXICAULE, n. sp.

Herbaceum, perenne, ramis gracilibus albo-incanis, foliis caulinis crebris lanceolatis amplexicaulibus facie viridibus subclavatis dorso persistenter

albo-incanis, capitulis parvis 8–10-floris dense corymboso-paniculatis, pedicellis brevibus lanuginosis, involucro oblongo bracteis multiseriatis oblongis obtusis luteis adpressis glabris dorso convexis, pappo albo flexuoso.

A herbaceous perennial, with slender terete stems, clothed with white tomentum. Lower stem-leaves about an inch long, $\frac{1}{6}$ in. broad, crowded, dilated at the base; upper shorter. Corymbs 1–3 in. broad, with ascending tomentose branches; heads very numerous. Involucre $\frac{1}{6}$ in. long, under $\frac{1}{8}$ in. in diam. Flowers yellow, $\frac{1}{8}$ in. long. Pappus as long as the corolla.—*Baron* 4964! Near *H. triplinerve*, DC.

HELICHRYSUM PLATYCEPHALUM, n. sp.

Herbaceum, perenne, caulibus erectis dense cæspitosis, sterilibus brevibus crebre foliatis, foliis linearibus uninerviis utrinque persistenter albo-incanis, floriferis elongatis 1–3-cephalis foliis dissitis reductis sessilibus ascendentibus, involucro magno late campanulato bracteis ovatis acutis multiseriatis scariosis glabris subæquilongis adpressis, pappo albo flexuoso.

An erect densely cæspitose perennial, with slender erect sparsely leafy 1–3-headed flowering-stems under a foot long and numerous short sterile branches. Leaves linear, persistently matted with white on both sides, those of the sterile stems $1\frac{1}{2}$–2 in. long, of the flower-stems smaller and suberect. Involucre $\frac{1}{2}$ in. in diam., not more than $\frac{1}{6}$ in. long; bracts glossy, bright yellow, scariose and glabrous down to the base. Flowers 100 or more to a head. Receptacle convex, $\frac{1}{4}$ in. in diam. Flowers $\frac{1}{8}$ in. long. Pappus as long as the corolla.—*Baron* 3485!

APHELEXIS FLEXUOSA, n. sp.

Fruticosa, ramosissima, ramulis gracilibus divaricatis albo-lanuginosis, foliis lanceolatis rigidulis adpressis dorso acute carinatis, capitulis 10–12-floris ad ramulorum apices paucis glomeratis, involucro obconico bracteis scariosis longe unguiculatis apicibus minutis oblongis brunneolis, pappi setis albidis flexuosis.

A much-branched shrub, with terete woody main stems and more or less ascending slender branchlets coated with white tomentum. Leaves adpressed to the branchlets, $\frac{1}{6}$ in. long. Heads in very numerous clusters at the tips of all the branchlets. Involucre $\frac{1}{6}$ in. long; bracts glossy, drab-brown, with very small spreading tips. Corolla $\frac{1}{8}$ in. long. Achene brown, glabrous. Pappus as long as the corolla.—*Baron* 3510! This and the two next are allied to *A. selaginifolia*, DC.

Aphelexis stenoclada, n. sp.

Fruticosa, ramosissima, ramulis confertis gracilibus erectis albo-lanuginosis, foliis lanceolatis rigidulis adpressis dorso acute carinatis, capitulis 6–8-floris paucis ad ramulorum apices dense corymbosis, involucro infundibulari bracteis longe unguiculatis apicibus patulis oblongis sulphureis, pappi setis albidis flexuosis.

A shrub, with slender densely-crowded ascending ultimate branchlets, which with the adpressed leaves do not exceed half a line in diameter. Leaves $\frac{1}{6}$ in. long, imbedded in the white tomentum that clothes the branchlets. Capitula in corymbs at the ends of all the branchlets. Involucre $\frac{1}{6}$ in. long, composed of 15 to 16 scariose bracts with minute spreading tips. Achene glabrous. Corolla $\frac{1}{8}$ in. long. Pappus-bristles falling singly.—*Baron* 3464!

Aphelexis sulphurea, n. sp.

Fruticosa, ramosissima, ramulis confertis gracilibus erectis albo-lanuginosis, foliis lanceolatis rigidulis adpressis dorso convexis, capitulis 8–10-floris paucis ad ramulorum apices corymbosis, involucro infundibulari bracteis longe unguiculatis apicibus patulis ovatis sulphureis, pappi setis albidis flexuosis.

A shrub, with woody main stems and crowded branchlets, which with the adpressed leaves are half a line in diameter. Leaves $\frac{1}{6}$ in. long, imbedded in the white tomentum of the branchlets. Capitula in corymbs at the ends of all the branchlets. Involucre $\frac{1}{6}$ in. long; bracts 10–12, sulphur-yellow, with ovate spreading tips half a line long. Achene glabrous. Corolla and pappus both $\frac{1}{8}$ in. long.—*Baron* 3459!

Astephanocarpa, genus novum Compositarum tribus Inuloideæ.

Capitula 2–3-flora homogama discoidea. Involucrum cylindricum deorsum lanuginosum, bracteis pauciseriatis oblongo-lanceolatis scariosis sursum albis glabris. Receptaculum nudum. Corollæ tubulosæ luteæ involucro breviores, apice breviter quinquefidæ, segmentis ovato-lanceolatis. Styli rami elongati falcati apice truncati. Antheræ basi sagittatæ, auriculis caudatis. Achenia cylindrica glabra, apice calva.

Habit of *Stenocline*, from which it differs by being entirely destitute of pappus.

Astephanocarpa arbutifolia, *Baker*. Species sola.

A shrub, glabrous in all its parts, with slender long stiff terete ultimate branchlets, closely leafy to the top. Leaves rigid,

sessile, ascending, oblanceolate, $\frac{3}{4}$–1 in. long, obscurely crenulate, brown when dried, with the copious reticulated veinlets raised on both surfaces. Heads very numerous, arranged in corymbose terminal clusters, bracteated by reduced ovate coriaceous leaves. Involucre nearly $\frac{1}{4}$ in. long, the scariose bracts brownish and woolly in the lower half, pure white and glabrous in the upper half. Corolla $\frac{1}{8}$ in. long. Achene much shorter than the corolla. —*Baron* 3488!

STOEBE CRYPTOPHYLLA, n. sp.

Fruticosa, ramosissima, ramulis confertis gracilibus erectis albo-tomentosis, foliis minutis lanceolatis rigidis ad ramum adpressis, capitulis spicatis erecto-patentibus, involucro cylindrico multiseriali bracteis exterioribus oblongis rigidis interioribus lanceolatis corneis, pappo albido plumoso flori æquilongo.

A much-branched erect heath-like shrub; branchlets, including the adpressed leaves, under a line in diameter. Leaves nearly black, $\frac{1}{12}$ in. long, quite adpressed to the white tomentose branchlets. Spikes $\frac{1}{2}$–1 in. long. Involucre $\frac{1}{6}$ in. long; outer rows of bracts similar to the leaves in texture, but smaller; inner horny, pale brown, glabrous. Flower solitary, as long as the involucre. Corolla and pappus $\frac{1}{8}$ in. long.—*Baron* 3349! Adds this characteristically Cape genus to the Madagascar flora. About 30 species are known at the Cape and 1 in Bourbon.

STOEBE BIOTOIDES, n. sp.

Fruticosa, ramosissima, ramulis confertis gracilibus erectis albo-tomentosis, foliis minutis rigidulis lanceolatis dorso convexis ad ramum adpressis, capitulis spicatis erecto-patentibus, involucro cylindrico multiseriali bracteis exterioribus parvis oblongis rigidis interioribus corneis ovatis vel lanceolatis, pappo albido plumoso flori æquilongo.

An ericoid shrub, with woody main stems $\frac{1}{4}$ in. in diam., and very numerous crowded ascending branchlets a line in diameter, including the adpressed leaves. Leaves rigid, brown-black, $\frac{1}{12}$ in. long. Spikes about $\frac{1}{2}$ in. long. Involucre $\frac{1}{6}$ in. long, with a few outer bracts similar in texture to the leaves, the horny inner ones much longer, drab-brown. Achene castaneous, glabrous, $\frac{1}{16}$ in. long. Pappus and corolla $\frac{1}{8}$ in. long.—*Baron* 3504!

EPALLAGE DISSITIFOLIA, n. sp.

E. ramulis dense breviter pubescentibus, foliis paucis remotis petiolatis ovatis serratis, capitulis paucis longe pedunculatis, involucro late campanulato bracteis herbaceis oblongis acutis adpressis pubescentibus, ligulis

multis brevibus, disco paleis lanceolatis rigidis, achenio glabro, pappo paleaceo.

A perennial herb, with slender terete pubescent ascending branchlets. Leaves small, distant, crenate, pubescent. Heads depresso-globose, $\frac{1}{3}$ in. in diam. Involucre $\frac{1}{6}$ in. long, densely hairy; bracts broad, greenish, foliaceous. Paleæ of the disk rigid, lanceolate, $\frac{1}{6}$ in. long. Achene subcylindrical, glabrous, $\frac{1}{16}$ in. long; pappus coroniform, paleaceous.—*Baron* 4743!

TEMNOLEPIS, genus novum Compositarum tribus Helianthoideæ.

Capitula multiflora homogama, floribus omnibus tubulosis hermaphroditis. Involucrum campanulatum, bracteis pauciseriatis oblongis acutis rigidulis adpressis. Receptaculum planum, paleis rigidulis laceratis floribus æquilongis præditum. Corollæ tubulosæ, apice breviter quinquefidæ. Antheræ basi haud caudatæ. Styli rami breves complanati. Achænia glabra cylindrica quadrangula, pappo obscuro coroniformi minute dentato.

Allied to *Epallage*, from which it differs by its homogamous flowers, large lacerated bracts of the receptacle, and obscure minutely-toothed pappus.

TEMNOLEPIS SCROPHULARIÆFOLIA, *Baker*.

An erect much-branched annual, with slightly pubescent slender stems, 1–2 ft. long. Leaves few, alternate; petiole $\frac{1}{2}$–$\frac{3}{4}$ in. long; blade cordate-deltoid, obtuse, coarsely irregularly crenate, 1–1$\frac{1}{4}$ in. long, thin in texture, green on both sides, obscurely hispid. Heads few, laxly corymbose at the end of the numerous branches; peduncles long, erect, glandular-pubescent, generally naked. Involucre campanulate, $\frac{1}{6}$ in. in diam.; paleæ few, rigid, oblong, subequal, pubescent, obtuse or cuspidate. Flowers each subtended by a tough whitish bract, lacerated at the apex, as long as the involucre and flower. Corolla yellow, subcylindrical, $\frac{1}{16}$ in. long, glandular downwards, constricted above the base. Styles not exserted. Achene as long as the corolla, clavate, greenish, glabrous, 4-angled, the pappus only an obscurely minutely toothed ring.—*Baron* 4303!

GYNURA SONCHIFOLIA, n. sp.

G. caule brevi dense piloso, foliis membranaceis lyrato-pinnatis, pedunculo elongato glanduloso-piloso, capitulis parvis copiose corymboso-paniculatis, paniculæ ramis dense pilosis, involucro oblongo bracteis linearibus, floribus involucro æquilongis, achenio glabro cylindrico, pappo albo fragili.

A perennial herb, with short densely pilose erect simple stems. Petiole 1–2 in. long; blade consisting of a large ovate terminal

segment 2–3 in. long and broad, and a single pair of small lateral segments. Peduncle slender, fragile, a foot long, with a short branch from the middle, and a lax end panicle with corymbose branches densely clothed with soft short crisped hairs. Involucre $\frac{1}{4}$ in. long, pilose like the pedicels; bracts about 8, with pale edges. Achene $\frac{1}{8}$ in. long, with about 10 ribs. Pappus copious, soft, deciduous, $\frac{1}{6}$ in. long.—*Baron* 3426!

CINERARIA ANAMPOZA, *Baker*,=Senecio Anampoza, *Baker in Journ. Linn. Soc.* xx. 191.

Sent now (*Baron* 4254!) with mature achenes. They are flattened and winged, and therefore it must be transferred to the genus *Cineraria* as defined in 'Genera Plantarum,' to the vicinity of the Cape *C. geraniifolia*, DC. Adds another characteristic Cape genus to the Madagascar flora.

SENECIO ACETOSÆFOLIUS, n. sp.

Sarmentosus, glaber, foliis petiolatis subcarnosis inferioribus hastatis superioribus ovatis, capitulis parvis radiatis paucifloris dense corymboso-paniculatis, involucro infundibulari bracteis 5 lanceolatis, ligulis luteis, floribus discoideis involucro longioribus, achenio piloso, pappo albo flexuoso.

A climber, with slender terete glabrous stems. Leaves distant, alternate, bright green, glabrous, lower 2 in. long and broad, with spreading deltoid auricles and a petiole as long as the blade. Panicles terminal on the branches, 3–4 in. broad, made up of several corymbose branches; pedicels as long as or shorter than the heads, copiously bracteate. Involucre $\frac{1}{6}$ in. long. Flowers about 6 in a head, 3 ligulate and 3 discoid. Pappus and disk-flowers $\frac{1}{6}$ in. long.—*Baron* 4357! 4360! Belongs to the group *Scandentes* as defined in 'Flora Capensis,' near *S. tamoides* of Natal.

SENECIO (§ KLEINOIDEI) CYCLOCLADUS, n. sp.

Fruticosus, carnosus, glaber, caulibus flexuosis dichotomiter ramosis, foliis parvis confertis oblanceolatis sessilibus uninerviis, pedunculo elongato nudo oligocephalo, capitulis radiatis multifloris, involucro campanulato bracteis 10–12 lanceolatis, ligulis luteis involucro æquilongis, floribus discoideis involucro superantibus, achenio glabro, pappo albo fragili.

Stems woody, flexuose, two or three times dichotomously forked. Young leaves crowded towards the ends of the branches, very fleshy, 1–1$\frac{1}{2}$ in. long, $\frac{1}{8}$ in. broad. Peduncles slender, stiffly erect, 3-headed; pedicels $\frac{1}{2}$–1$\frac{1}{2}$ in. long, minutely bracteate. Involucre

$\frac{1}{6}$ in. long and broad. Ligules about 8, $\frac{1}{4}$ in. long. Pappus and disk-flowers $\frac{1}{6}$ in. long. Achene not seen fully developed.—*Baron* 4272!

SENECIO (§ KLEINOIDEI) MELASTOMÆFOLIUS, n. sp.

Fruticosus, carnosus, glaber, ramis cylindricis, foliis sessilibus carnosis oblongis acutis integris confertis, pedunculo gracili oligocephalo, capitulis radiatis multifloris, involucro campanulato bracteis 10–12 lanceolatis, ligulis luteis, pappo albo flexuoso.

Stems short, thick, fleshy, curved, forked, bare except at the tip. Leaves crowded at the tips of the branches, ascending, 1–$1\frac{1}{2}$ in. long, $\frac{1}{3}$–$\frac{1}{2}$ in. broad, distinctly triplinerved from the base upwards. Peduncles slender, naked, 2–3 in. long, 3-4-headed. Involucre $\frac{1}{6}$ in. in diam. Ligules 8–10, linear. Disk-flowers not exserted from the involucre. Pappus $\frac{1}{6}$ in. long.—*Baron* 3569!

SENECIO (KLEINOIDEI) VERNICOSUS, n. sp.

Fruticosus, carnosus, glaber, foliis confertis sessilibus oblanceolatis obtusis integris ascendentibus trinervatis, capitulis radiatis multifloris corymboso-paniculatis, involucro campanulato bracteis 9–10 lanceolatis, ligulis parvis luteis, floribus discoideis, involucro duplo longioribus, achenio hispidulo, pappo albido fragili.

Leafy stems woody, $\frac{1}{6}$–$\frac{1}{4}$ in. in diam. Leaves 3–4 in. long, $\frac{5}{8}$–$\frac{3}{4}$ in. broad, shining as if varnished, narrowed gradually from the middle to the base, triplinerved down to the base. Peduncles naked, 3–4 in. long, including the corymb; ascending minutely bracteated peduncles longer than the heads. Involucre $\frac{1}{6}$ in. long and broad. Ligules small, yellow. Achene cylindrical, $\frac{1}{8}$ in. long. Pappus soft, white, $\frac{1}{8}$ in. long.—*Baron* 3563!

SENECIO (§ KLEINOIDEI) CICATRICOSUS, n. sp.

Fruticosus, carnosus, glaber, ramis furcatis, foliorum delapsorum basibus rugosis, foliis confertis sessilibus ascendentibus lineari-subulatis, pedunculo nudo brevi oligocephalo, capitulis multifloris radiatis, involucro campanulato bracteis circiter 8 basi connatis, ligulis patulis luteis, achenio glabro, pappo albo fragili.

Stems woody, cylindrical, $\frac{1}{2}$ ft. long, simple or once or twice dichotomously forked. Young leaves crowded towards the tips of the branches, very fleshy, acute, 1–$1\frac{1}{2}$ in. long. Peduncles slender, stiffly erect, 1–4 in. long, 1–7-headed. Involucre $\frac{1}{6}$ in. in diam., glabrous. Ligules about 8, $\frac{1}{4}$ in. long. Disk-flowers rather longer than the involucre. Achene brown, cylindrical, $\frac{1}{8}$ in. long. Pappus and disk-corollas $\frac{1}{6}$ in. long.—*Baron* 3564! Near *S. canaliculatus*, Bojer.

SENECIO (§ KLEINOIDEI) MONOCEPHALUS, n. sp.

Fruticosus, carnosus, ramis crassis foliorum delapsorum basibus rugosis, foliis confertis sessilibus ascendentibus lineari-subulatis carnosis glabris, pedunculo brevissimo monocephalo, capitulis radiatis multifloris, involucro campanulato piloso, bracteis lanceolatis, ligulis parvis luteis, floribus discoideis involucro æquilongis, achenio glabro, pappi setis albidis flexuosis.

A fleshy erect undershrub a foot high, with stout branchlets rough with the raised bases of the old leaves. Young leaves crowded towards the ends of the stems, $\frac{1}{2}$ in. long, $\frac{1}{12}$ in. in diam., acute. Peduncle not longer than the leaves. Involucre campanulate, $\frac{1}{4}$ in. long and broad; bracts about 12 and a few small ones at the base. Ligules spreading, $\frac{1}{4}$ in. long. Achene only seen immature. Pappus $\frac{1}{6}$ in. long.—*Baron* 3561!

SENECIO (§ KLEINIA) HILDEBRANDTII, n. sp.

Fruticosus, carnosus, glaber, ramis crassis deorsum foliorum delapsorum basibus rugosis, foliis confertis ascendentibus subulatis carnosis, capitulis parvis discoideis copiose corymboso-paniculatis, pedunculis bracteatis, involucro infundibulari bracteis 5 lanceolatis, floribus involucro sesquilongioribus, achenio glabro, pappo albo fragili.

Stems 1–1$\frac{1}{2}$ ft. long, simple or dichotomously forked, leafy in the upper half. Leaves crowded, ascending, very fleshy, 2–3 in. long, under a line in diameter. Panicles dense, level-topped, 2–4 in. in diam. Involucre $\frac{1}{8}$ in. long; pedicels with lanceolate bracts at the middle and base. Flowers all discoid, 5 in a head. Achene only seen immature. Pappus and corolla $\frac{1}{6}$ in. long.—*Baron* 3562! 4218! Also *Hildebrandt* 3628! From Andrangaloaka, on sunny hill-sides.

GERBERA EMIRNENSIS, n. sp.

Perennis, rhizomate dense piloso, foliis petiolatis oblanceolato-oblongis dentatis subcoriaceis utrinque glabris, pedunculo gracili stricto elongato pubescente, involucro campanulato bracteis paucis lanceolatis pubescentibus, ligulis exsertis, floribus discoideis involucro æquilongis, achenio cylindrico piloso, pappo albido setoso.

A perennial, with a thick short erect pilose rootstock, and a rosette of radical leaves. Leaves 1$\frac{1}{2}$–2 in. long, $\frac{1}{3}$–$\frac{1}{2}$ in. broad, narrowed gradually to the base, moderately firm in texture, dark green; petiole pilose, $\frac{1}{2}$–1 in. long. Peduncle slender, erect, densely pubescent, about $\frac{1}{2}$ in. long. Involucre $\frac{1}{2}$ in. long and broad; outer bracts gradually shorter. Receptacle naked,

slightly convex, $\frac{1}{8}$ in. in diam. Flowers yellow. Achenes only seen immature. Pappus $\frac{1}{4}$ in. long; bristles white, flexuose.—*Baron* 3457!

PHILIPPIA CRYPTOCLADA, n. sp.

Ramosissima, glabra, ramulis gracillimis erectis, foliis minutis rigidis oblongis ternis ad ramulum adpressis, floribus 1–3nis terminalibus, calycis segmentis ovatis, corollæ tubo campanulato segmentis brevibus latis, staminibus inclusis connatis, stylo incluso stigmate peltato.

An erect shrub, with slender crowded erect branchlets, hidden by the adpressed leaves, not more than half a line in diameter, leaves included. Leaves green, oblong, rigid, glabrous, $\frac{1}{12}$ in. long, quite adpressed to the stems, the upper whorls imbricated. Flowers few and inconspicuous. Calyx similar to the leaves in texture. Corolla $\frac{1}{2}$ lin. in diam. Stamens and style not protruded from the corolla.—*Baron* 3499! Differs from all the following by its erect adpressed leaves.

PHILIPPIA CAPITATA, n. sp.

Ramosissima, ramulis pallidis dense hispidis, foliis quaternis lanceolatis rigidulis ascendentibus parce glanduloso-hispidulis marginibus late revolutis, floribus dense capitatis, calycis segmentis ovatis, corollæ campanulatæ segmentis orbicularibus, staminibus liberis inclusis, stylo longe exserto, stigmate magno peltato.

A much-branched shrub, with slender pale densely hispid branchlets. Leaves $\frac{1}{6}$ in. long, pale green, obtuse, more or less ascending. Flowers in dense clusters at the ends of the branchlets; pedicels as long as the corolla. Calyx half as long as the corolla. Corolla red, $\frac{1}{12}$ in. in diam. Pistil twice as long as the corolla.—*Baron* 3481!

PHILIPPIA HISPIDA, n. sp.

Ramosissima, ramulis pallidis dense hispidis, foliis parvis oblongis rigidulis patulis quaternis dense glanduloso-hispidis marginibus late revolutis, floribus dense capitatis, calycis segmentis ovatis obtusis, corollæ campanulatæ segmentis latis obtusis, staminibus breviter exsertis antheris apice liberis deorsum leviter coalitis, stylo breviter exserto stigmate haud peltato.

A much-branched shrub, with drab branchlets densely clothed with very unequal stiff spreading hairs. Leaves $\frac{1}{12}$ in. long, densely clothed with stiff spreading glandular bristles. Flowers in dense clusters at the ends of the branchlets; pedicels as long

as the corolla. Calyx densely pilose, half as long as the corolla. Corolla $\frac{1}{12}$ in. long and broad. Anthers 8, short, slightly exserted. Style just overtopping the anthers.—*Baron* 3335!

PHILIPPIA TRICHOCLADA, n. sp.

Ramosissima, ramulis pallidis erectis pubescentibus, foliis quaternis oblongis rigidulis erecto-patentibus parce glanduloso-hispidis marginibus late revolutis, floribus sparsis 1–2nis, pedicellis flori æquilongis, calycis segmentis ovatis obtusis, corollæ tubo campanulato segmentis latis brevibus, staminibus inclusis connatis, stylo exserto stigmate magno peltato.

A much-branched shrub, with crowded erect densely pubescent branchlets. Lower leaves $\frac{1}{8}$–$\frac{1}{6}$ in., upper $\frac{1}{12}$ in. long. Pedicels densely pubescent, $\frac{1}{12}$ in. long. Calyx nearly as long as the corolla; segments similar to the leaves in texture, ciliated with bristles. Corolla red, $\frac{1}{12}$ in. long and broad. Pistil twice as long as the corolla.—*Baron* 3480!

PHILIPPIA MINUTIFOLIA, n. sp.

P. ramulis gracillimis erectis pubescentibus, foliis minutis oblongis rigidulis mucronatis ascendentibus quaternis parce glanduloso-hispidulis marginibus late revolutis, floribus paucis 1–3nis terminalibus, calycis segmentis ovatis, corollæ campanulatæ segmentis latis brevibus, staminibus liberis inclusis, stylo longe exserto stigmate magno peltato.

A much-branched shrub, with very slender erect branchlets with a loose white epidermis. Leaves crowded, erecto-patent, at most a line long, with a few gland-tipped bristles. Flowers terminal on the branchlets; pedicels very short, densely glandular. Corolla bright red, campanulate, glandular, $\frac{3}{4}$ line long and broad. Calyx glandular, half as long as the corolla. Stamens 8, as long as the corolla. Pistil twice as long as the corolla.—*Baron* 4458!

ARDISIA LEPTOCLADA, n. sp.

Fruticosa, ramulis gracillimis pubescentibus, foliis breviter petiolatis ovatis acutis submembranaceis præter costam faciei inferioris glabris, cymis axillaribus sessilibus 1–3-floris, pedicellis elongatis, calycis segmentis suborbicularibus, corollæ segmentis oblongis, antheris liberis oblongis, fructu globoso glabro.

A much-branched erect shrub with very slender flexuose branchlets. Leaves 1–1½ in. long, rounded at the base, thin in texture, green on both sides, pubescent only on the midrib beneath; petiole always very short. Pedicels slender, curved,

$\frac{3}{4}$–1 in. long. Flowers pentamorous. Calyx campanulate, $\frac{1}{12}$ in. in diam.; segments much imbricated. Corolla $\frac{1}{12}$ in. long; tube very short. Stamens nearly as long as the corolla.—*Baron* 3674!

ARDISIA DISSITIFLORA, n. sp.

Fruticosa, ramulis gracilibus pilosis, foliis breviter petiolatis oblongis acutis subcoriaceis dorso ad costam solum pilosis, cymis axillaribus pedunculatis circiter trifloris pedicellis elongatis, floribus tetrameris, calycis segmentis ovatis, acutis, corollæ segmentis ovatis, staminibus liberis, antheris lanceolatis, filamentis brevissimis.

A shrub, probably a climber, with slender terete pilose branchlets. Leaves about an inch long, firm in texture, green and glabrous on both surfaces except the midrib beneath, copiously dotted with black. Cymes copious, axillary; peduncle and pedicels each $\frac{1}{2}$–$\frac{3}{4}$ in. long, slightly pilose. Calyx $\frac{1}{12}$ in. in diam., tube very short. Corolla $\frac{1}{8}$ in. in diam. Stamens 4; anthers lanceolate, much longer than the filaments.—*Baron* 4511! Habit of *Oncostemum vacciniifolium*, but stamens quite free.

ONCOSTEMUM? POLYTRICHUM, n. sp.

Fruticosum, dense molliter fusco-pilosum, foliis magnis petiolatis oblongis subcoriaceis, floribus pentameris dense copiose racemosis, pedicellis elongatis, calycis segmentis ovatis, corollæ segmentis ovatis acutis tubo campanulato longioribus, filamentis brevibus connatis, antheris liberis lanceolatis.

Branches woody, terete, densely clothed with short brown pubescence. Leaves 3–4 in. long, $1\frac{1}{4}$–$1\frac{1}{2}$ in. broad at the middle, narrowed gradually to both ends, firm in texture, green and clothed with short brown pubescence on both surfaces; petiole $\frac{1}{2}$ in. long. Flowers in dense peduncled panicled terminal racemes; pedicels $\frac{1}{3}$–$\frac{1}{2}$ in. long, densely pilose. Expanded calyx $\frac{1}{8}$ in. in diam. Corolla glabrous, $\frac{1}{8}$ in. in diam. Stamens shorter than the corolla; anthers lanceolate; filaments united in a campanulate cup.—*Baron* 2219! 3878! Combines the habit and anthers of *Ardisia* with the connate filaments of *Oncostemum*.

ONCOSTEMUM MICROSPHÆRUM, n. sp.

Fruticosum, erectum, ramosissimum, ramulis dense pilosis, foliis breviter petiolatis orbicularibus parvis glabris, floribus pentameris 1–3nis axillaribus, pedunculo brevi, pedicellis elongatis, calycis segmentis ovatis obtusis, corollæ tubo brevi segmentis orbicularibus, coronæ campanulatæ filamentis deltoideis basi solum connatis.

A much-branched small shrub, with very slender branchlets, densely clothed with stiff brown hairs. Leaves $\frac{1}{4}$–$\frac{1}{3}$ in. long and broad, moderately firm in texture, green and glabrous on both surfaces, closely dotted with black. Peduncle very short, pilose; pedicels erect, glabrous, $\frac{1}{4}$ in. long. Calyx spreading horizontally, $\frac{1}{12}$ in. in diam. Corolla $\frac{1}{12}$ in. in diam.; bud globose; segments much imbricated. Stamens included.—*Baron* 4462!

ONCOSTEMUM VACCINIIFOLIUM, n. sp.

Fruticosum, erectum, ramulis gracilibus pilosis, foliis brevissime petiolatis oblanceolato-oblongis acutis subcoriaceis præter costam glabris, floribus tetrameris, cymis axillaribus sæpissime bifloris, pedunculis pedicellisque elongatis, calycis segmentis ovatis obtusis, corollæ segmentis ovatis, antheris coalitis, filamentis brevissimis.

A much-branched erect shrub, with erecto-patent or spreading slender pubescent branchlets. Leaves 1–1$\frac{1}{2}$ in. long, $\frac{1}{3}$–$\frac{1}{2}$ in. broad, firm in texture, green on both sides, hairy only on the midrib beneath. Cymes copiously produced from the axils of the leaves; peduncle about $\frac{1}{2}$ in. long; pedicels $\frac{1}{4}$–$\frac{1}{3}$ in. long, curved, glandular-pubescent. Expanded calyx flat, $\frac{1}{8}$ in. in diam. Corolla $\frac{1}{6}$ in. in diam. Stamens inserted low down in the corolla; filaments very short.—*Baron* 3858! 3773!

ONCOSTEMUM FLEXUOSUM, n. sp.

Fruticosum, sarmentosum, ramulis flexuosis sursum obscure glanduloso-pubescentibus, foliis breviter petiolatis oblongis acutis subcoriaceis glabris, floribus pentameris, cymis axillaribus paucifloris, calycis segmentis orbicularibus, corollæ segmentis ovatis obtusis, filamentis perfecte connatis, fructu globoso magnitudine pisi

A climber, with slender terete branchlets. Leaves 1–2 in. long, narrowed to the base, moderately firm in texture, green and glabrous on both sides, petiole $\frac{1}{8}$–$\frac{1}{4}$ in. long. Cymes 3–5-flowered from the axils of the leaves; peduncle $\frac{1}{2}$–$\frac{3}{4}$ in. long; pedicels very slender, 3–4 times as long as the flowers. Corolla $\frac{1}{6}$ in. in diam. Anthers placed inside a ring a little shorter than the corolla.—*Baron* 4134!

ONCOSTEMUM BOTRYOIDES, n. sp.

Fruticosum, glabrum, foliis magnis petiolatis oblanceolato-oolongis obtusis coriaceis, floribus pentameris laxe copiose racemosis, pedicellis arcuatis flore longioribus, calycis segmentis orbicularibus ciliatis late imbricatis, corollæ segmentis orbicularibus, staminibus connatis.

Branches moderately robust, terete. Leaves 3–4 in. long,

1–1½ in. broad, narrowed gradually from the middle to base, firm in texture, green and glabrous on both surfaces; petiole ½ in. long. Flowers in copious lax axillary peduncled racemes 3–4 in. long; pedicels ¼ in. long. Expanded calyx ⅛ in. in diam. Corolla ⅙ in. in diam.; tube very short. Filaments connate, in a campanulate cup shorter than the corolla, inside which the stamens are placed.—*Baron* 1096! 3714!

PACHYPODIUM DENSIFLORUM, n. sp.

P. tubero firmo polycephalo, rosulis dense aculeatis, foliis oblongis dorso pilosis, pedunculo elongato, cymis densis paucifloris, calycis segmentis ovatis lanosis, corollæ tubo cylindrico piloso calyce longiore, segmentis obovatis, folliculis cylindricis elongatis.

Tuber with several cylindrical branches, densely armed with spreading subulate pungent prickles ¼ in. long. Leaves only seen immature, more or less coated with short white pubescence beneath. Peduncle reaching nearly a foot in length. Flowers 6–8 in a dense cyme. Calyx-segments ¼ in. long. Corolla-tube nearly twice as long as the calyx; segments obovate, ⅓ in. long. Follicles pubescent, 4 in. long. Seeds cylindrical, ⅙ in. long, crowned by a corona of silky hairs.—*Baron* 4246!

PACHYPODIUM BREVICAULE, n. sp.

P. tubero firmo polycephalo, rosulis copiose aculeatis, foliis hysteranthiis oblongis, pedunculo brevi pubescente interdum nullo, cymis densis paucifloris, calycis segmentis lanceolatis dense pilosis, corollæ luteæ tubo cylindrico pubescente segmentis obovatis tubo brevioribus.

Tuber subglobose, ¾–1 in. in diam. Prickles in a dense cluster, pale, subulate, erect, ¼ in. long. Leaves at the flowering-time very immature, oblong, densely pilose. Pedicels very short. Calyx densely pilose, ⅓ in. long; tube very short. Corolla-tube ¾ in. long, densely pubescent on the outside; segments ½ in. long. Stamens not reaching above the middle of the corolla-tube.—*Baron* 4412! Also *Hildebrandt* 3586!

ALYXIA LUCIDA, n. sp.

Sarmentosa, fruticosa, glabra, foliis 2–4nis sessilibus lanceolatis vel oblongo-lanceolatis acuminatis lucidis subcoriaceis, cymis laxis paucifloris terminalibus, calycis segmentis minutis ovatis, corollæ tubo elongato cylindrico, segmentis angustis tubo 4–5plo brevioribus, fructu pedicellato splendide rubro profunde toruloso.

A climber, glabrous in all its parts, with very slender green

branchlets. Leaves $1\frac{1}{2}$–2 in. long, $\frac{1}{3}$–$\frac{1}{2}$ in. broad at the middle, moderately firm in texture, green and glabrous on both surfaces, glossy above. Cymes few-flowered, shortly peduncled; pedicels erect, about $\frac{1}{2}$ in. long. Calyx $\frac{1}{12}$ in. long. Corolla-tube $\frac{3}{4}$ in. long; expanded limb $\frac{1}{3}$ in. in diam., very contorted before expansion; segments oblong. Fruit of 1–5 oblong or globose joints $\frac{1}{4}$–$\frac{1}{3}$ in. long, green at first, finally bright scarlet.—*Baron* 4551! 4663! 4888!

MASCARENHAISIA GERRARDIANA, n. sp.

Sarmentosa, glabra, ramulis gracilibus, foliis oppositis breviter petiolatis oblongis acutis rigide coriaceis, floribus splendide rubris in cymas paucifloras terminales dispositis, calycis tubo brevi segmentis ovatis, corollæ tubo cylindrico segmentis oblongis, antheris lanceolatis infra tubi medium insertis.

A climber, glabrous in all its parts, with slender purplish-black branchlets. Leaves erecto-patent, $1\frac{1}{2}$–2 in. long, $\frac{3}{4}$–1 in. broad, narrowed to both ends, firm in texture, green and glabrous on both surfaces, with the veins and veinlets beneath raised. Cymes 1–6-flowered, shortly peduncled; bracts small, ovate. Calyx $\frac{1}{12}$ in. long. Corolla-tube $\frac{3}{4}$ in. long, constricted in the lower third; expanded limb above an inch in diameter. Anthers $\frac{1}{4}$ in. long. Fruit not seen.—*Baron* 2510! 4652! Also *Gerrard* 52! *L. Kitching*! Nearly allied to *M. Curnowiana*, Hemsley; Bot. Mag. t. 6612.

MASCARENHAISIA MACROSIPHON, n. sp.

Glabra, ramulis gracilibus pallidis, foliis petiolatis oblongo-lanceolatis subcoriaceis venulis faciei inferioris immersis, floribus solitariis axillaribus breviter pedunculatis, calycis segmentis parvis ovatis, corollæ tubo elongato cylindrico infra medium constricto, segmentis oblique obovatis, antheris in tubo inclusis infra medium insertis.

A shrub, with slender branchlets, glabrous in all its parts. Leaves opposite, erecto-patent, 2–3 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad at the middle, narrowed gradually to both ends, moderately firm in texture, green and glabrous on both surfaces, the veins fine and indistinct; petiole $\frac{1}{6}$ in. long. Peduncle $\frac{1}{2}$ in. long, erect. Calyx $\frac{1}{12}$ in. long. Corolla apparently white; tube $1\frac{1}{4}$ in. long, conspicuously constricted below the insertion of the stamens; limb above an inch in diameter. Fruit not seen.—*Baron* 3840!

STRYCHNOS BARONI, n. sp.

Glabra, ramulis gracilibus copiose lenticellatis, foliis petiolatis oblongis

acutis triplinerviis, cymis axillaribus paucifloris, bracteis ovatis, pedicellis brevibus, calyce tubo brevi segmentis ovatis obtusis ciliatis, corollæ tubo brevi cylindrico intus dense piloso, segmentis oblongis tubo æquilongis, antheris oblongis ad tubi faucem subsessilibus.

An erect tree, with glabrous branchlets. Leaves opposite, 2–3 in. long, 1–1¼ in. broad at the middle, narrowed gradually to both ends, moderately firm in texture, green and glabrous on both surfaces, triplinerved from a little above the base. Cymes shortly peduncled, much shorter than the leaves; pedicels $\frac{1}{8}$–$\frac{1}{6}$ in. long. Calyx $\frac{1}{12}$ in. long; segments imbricated, densely ciliated. Corolla $\frac{1}{6}$ in. long. Anthers shorter than the perianth-segments. Style reaching to the top of the anthers. Fruit not seen.—*Baron* 4648!

Buddleia sphærocalyx, n. sp.

B. ramis robustis dense pubescentibus, foliis magnis oblongis acutis crenatis basi late connatis, racemis axillaribus breviter pedunculatis, calyce globoso ventricoso pubescente dentibus parvis, corollæ tubo cylindrico calyci æquilongo, limbi segmentis parvis orbicularibus, fructu nigro glabro calyce rumpente.

Stems stout, erect, woody, densely pubescent. Leaves 4–6 in. long, 1½–2 in. broad, moderately firm in texture, finely crenate, pubescent on both surfaces, connate at the base for half an inch on each side of the stem. Racemes dense, 1⅓–2 in. long; peduncle short, densely pubescent; pedicels $\frac{1}{4}$ in. long; bracts lanceolate. Calyx bladder-like, densely pubescent, $\frac{1}{6}$ in. long and broad; teeth minute, lanceolate-deltoid. Corolla hypocrateriform; limb $\frac{1}{8}$ in. in diam.; segments 4, orbicular. Fruit $\frac{1}{4}$ in. in diam.—*Baron* 4401! A very curious and distinct species.

Nuxia sphærocephala, *Baker.*

More mature specimens in the present parcel (*Baron* 3738!) of the plant which I described in Journ. Linn. Soc., Bot. vol. xxi. p. 425, as *Buddleia sphærocephala* show it to have divaricate anther-lobes, and a corolla falling off by circumscissile dehiscence, so that it must be transferred to the genus *Nuxia*, to the neighbourhood of *N. capitata*, *N. terminalioides*, and *N. pachyphylla*.

Nuxia terminalioides, n. sp.

N. ramulis tenuiter pubescentibus, foliis oppositis petiolatis oblanceolato-oblongis subcoriaceis subacutis serratis dorso obscure pubescentibus, floribus in capitula globosa laxe paniculata aggregatis, calyce coriaceo tubo companulato, dentibus deltoideis, corollæ tubo cylindrico segmentis oblongis, genitalibus exsertis.

An erect shrub, with slender shortly pubescent branchlets. Leaves 2–3 in. long, 1–$1\frac{1}{4}$ in. broad above the middle, narrowed gradually from the middle to the base, firm in texture, green on both surfaces, with 6–8 raised ascending main veins. Heads $\frac{1}{3}$ in. in diam., arranged in a terminal panicle about 3 in. long and broad, the lower branches bracteated at the base by large leaves. Calyx dark brown, coriaceous, pubescent, $\frac{1}{8}$ in. long; teeth $\frac{1}{3}$–$\frac{1}{4}$ as long as the tube. Corolla-tube $\frac{1}{8}$ in. long; segments $\frac{1}{3}$ as long as the tube.—*Baron* 3629!

NUXIA PACHYPHYLLA, n. sp.

N. ramulis pubescentibus, foliis oppositis vel ternis breviter petiolatis oblanceolato-oblongis obtusis integris subcoriaceis venis primariis 6–8-jugis exsculptis, floribus in capitula globosa paniculata aggregatis, calyce piloso coriaceo tubo infundibulari dentibus ovatis, corollæ tubo cylindrico segmentis oblongis obtusis, genitalibus exsertis.

A shrub or small tree, with woody pubescent branchlets. Leaves opposite or ternate, ascending, 2–4 in. long, 1–2 in. broad above the middle, narrowed gradually from the middle to the base, strongly ribbed beneath, at first pubescent, finally glabrous. Heads $\frac{5}{8}$–$\frac{3}{4}$ in. in diam. exclusive of the style and stamens, arranged in lax deltoid terminal panicles 3–4 in. long. Calyx brown-black, very coriaceous, $\frac{1}{6}$ in. long. Corolla-lobes $\frac{1}{8}$ in. long. Stamens $\frac{1}{6}$ in. longer than the calyx; anthers broadly reniform. Style overtopping the anthers.—*Baron* 1326! 3389! 4056! 4407!

ANTHOCLEISTA AMPLEXICAULIS, n. sp.

Glabra, foliis magnis obovatis amplexicaulibus, floribus copiose corymboso-paniculatis, bracteis late connatis, calycis segmentis orbicularibus late imbricatis, corollæ tubo cylindrico calyci æquilongo segmentis 9–10 oblongis, antheris segmentis paulo brevioribus.

Branchlets woody, robust. Leaves a foot long, 5 in. broad, obtuse, narrowed gradually from the middle to the amplexicaul base, subcoriaceous, green and glabrous on both surfaces, with 8–9 pairs of distant erecto-patent parallel main veins. Panicle dense, terminal, half a foot broad; lower bracts with a long, upper with a very short point. Calyx $\frac{1}{3}$ in. in diam.; inner segments in. broad. Corolla-segments $\frac{1}{3}$ in. long. Anthers lanceolate, $\frac{1}{4}$ in. long.—*Baron* 3795! Allied to *A. Vogelii*, Planch., in Hook. Ic. t. 3795. Native name *Landemy*.

ANTHOCLEISTA RHIZOPHOROIDES, n. sp.

Glabra, foliis petiolatis obovato-oblongis obtusis rigide coriaceis, cymis

paucifloris, bracteis parvis, calycis segmentis orbicularibus valde imbricatis, corollæ tubo calyci æquilongo, segmentis 9–10 oblongis, fructu ovoideo.

Branchlets woody, terete, marked with the rings left by the fallen leaves. Leaves opposite, erecto-patent; petiole $\frac{1}{2}$ in. long; blade 3–4 in. long, 1–1$\frac{1}{2}$ in. broad above the middle, cuneate at the base, green and glabrous on both surfaces, the side-veins fine and immersed. Cymes lax, terminal. Calyx $\frac{1}{4}$ in. long; inner segments $\frac{1}{4}$ in. broad. Corolla an inch long; segments as long as the tube. Fruit $\frac{1}{2}$ in. in diam.—*Baron* 1952! 3814!

BELMONTIA EMIRNENSIS, n. sp.

Glabra, foliis sessilibus oblongis acutis, floribus copiose corymboso-paniculatis, calyce late quinquealato segmentis acuminatis, corollæ segmentis ovatis tubo urceolato longioribus, staminibus ex corollæ tubo longe exsertis, filamentis brevissimis.

A glabrous perennial herb, with simple erect stems 3 ft. long. Leaves opposite, decussate, triplinerved, the central ones about 2 in. long, the upper shorter and remote. Flowers numerous, bright yellow, arranged in a terminal panicle with erect corymbose branches; bracts ovate-lanceolate, foliaceous; pedicels $\frac{1}{2}$ in. long. Calyx campanulate, $\frac{1}{6}$ in. in diam., all the lobes acuminate and broadly winged. Corolla $\frac{1}{2}$–$\frac{5}{8}$ in. long. Anthers $\frac{1}{6}$ in. long. Ovary ovoid; style $\frac{1}{3}$ in. long, reaching nearly to the tip of the corolla-segments.—*Baron* 4187! Adds another characteristic Cape genus to the Madagascar flora.

IPOMŒA (§ STROPHIPOMŒA) RUBRO-VIRIDIS, n. sp.

Herbacea, volubilis, glabra, caulibus gracillimis, foliis remotis sessilibus linearibus integris uninerviis, floribus magnis axillaribus solitariis breviter pedunculatis, calycis segmentis exterioribus oblongis, corolla infundibulari intus rubella extus viridula, fructu parvo globoso.

An herbaceous climber, glabrous in all its parts, with very slender stems. Leaves 2–3 in. long, $\frac{1}{12}$–$\frac{1}{6}$ in. broad, narrowed to an indistinct petiole, moderately firm in texture, green, glabrous. Peduncle $\frac{1}{4}$–$\frac{1}{3}$ in. long, erect, thickened upwards. Calyx $\frac{1}{4}$ in. long; three inner segments longer, narrower, and more acute than the two outer. Corolla 1$\frac{1}{2}$–1$\frac{3}{4}$ in. long, about $\frac{1}{2}$ in. in diam. at the throat. Capsule $\frac{1}{3}$ in. in diam., tipped with the persistent style. —*Baron* 4728! 4832! Near the Australian *I. graminea*, R. Br.

IPOMŒA (§ ORTHIPOMŒA) SYRINGÆFOLIA, n. sp.

Fruticosa, erecta, ramulis sursum dense pubescentibus, foliis longe petiolatis ovatis integris acutis utrinque breviter pubescentibus, floribus

copiose cymoso-paniculatis, pedunculis pedicellisque dense pubescentibus, calycis segmentis oblongis, corolla obconica calyce 5-6plo longiora extus hispidula, segmentis parvis deltoideis, genitalibus corolla duplo brevioribus.

An erect shrub, with slender terete branchlets, clothed, like the peduncles, leaves, and calyx, with short adpressed whitish pubescence. Leaves simple, 2–4 in. long, acute, rounded at the base, quite entire, moderately firm in texture, green and shortly pilose on both surfaces. Flowers copious, forming a terminal panicle, with ascending level-topped branches, bracteated at the base by large leaves. Calyx $\frac{1}{6}$ in. long, the two outer segments hiding the rest. Corolla an inch long, probably reddish. Style $\frac{1}{2}$ in. long; stigmas globose.—*Baron* 4674!

BREWERIA TILIÆFOLIA, n. sp.

Volubilis, fruticosa, ramulis gracilibus pubescentibus, foliis petiolatis integris cordato-ovatis cuspidatis utrinque pubescentibus, floribus axillaribus dense racemosis, pedicellis brevissimis, calyce piloso tubo campanulato dentibus deltoideis, corolla obconica glabra, segmentis obtusis brevissimis, stylo staminibus eminente stigmatibus globosis.

A climber, with slender terete densely pubescent branchlets. Leaves distant, alternate; petiole about an inch long; blade 2–3 in. long, thin, green, and shortly pubescent on both surfaces. Racemes copious, nearly sessile, 1–1$\frac{1}{2}$ in. long, sometimes compound at the base. Calyx $\frac{1}{12}$ in. in diam., densely pilose. Corolla $\frac{1}{3}$ in. long and broad, probably white. Stamens unequal, less than half as long as the corolla; anthers small, oblong.—*Baron* 4580! 4817!

DIDYMOCARPUS PUSILLUS, n. sp.

Annuus, fragilis, caule producto simplici piloso, foliis petiolatis oblongis obtusis inciso-crenatis facie glabris dorso parce pilosis basi cuneatis, pedunculo terminali piloso 1–2-floro, calycis segmentis lineari-oblongis, corollæ tubo oblongo segmentis brevibus.

An erect fragile annual, about 2 inches high. Leaves $\frac{1}{2}$ in. long, membranous, green above, pale green beneath, with four pairs of arcuate main veins; petiole $\frac{1}{6}$ in. long. Calyx $\frac{1}{6}$ in. long, cleft down nearly to the base. Corolla reddish, twice as long as the calyx.—*Baron* 3440!

THUNBERGIA CHRYSOCHLAMYS, n. sp.

Volubilis, fruticosa, ramis glabris, foliis petiolatis oblongis acutis integris coriaceis glabris, floribus pluribus axillaribus, pedicellis elongatis

luteo-incanis, bracteis coriaceis connatis persistenter aureo-incanis, calyce truncato brevissimo, corollæ tubo piloso lobis brevibus, stigmate exserto.

A shrubby climber, with woody terete stems. Leaves 2½–3 in. long, 1–1½ in. broad at the middle, acute, firm in texture, green and glabrous on both surfaces; petiole ½ in. long. Flowers a dozen or more in sessile cymes in the axils of the leaves; pedicels ¼–⅓ in. long, clothed with persistent golden-yellow tomentum like the bracts. Bracts oblong, ½ in. long, coriaceous, connate nearly to the top; lobes half-orbicular. Calyx densely pilose. Corolla 1¼ in. long, clothed with bristly hairs; tube infundibuliform; throat ⅓ in. in diam.; lobes short, rounded. Stamens reaching to the throat of the corolla-tube. Capsule not seen.—*Baron* 4915! Numbers 4762 and 4770 are either the same species or a near ally, but are incomplete. To be compared with Radlkofer's genus *Pseudocalyx*.

MIMULOPSIS AFFINIS, n. sp.

Herbacea, caulo erecto gracillimo sursum glanduloso-pubescente, foliis petiolatis lanceolatis parce pilosis, floribus paucis luteis laxe racemosis, pedicellis elongatis glanduloso-pubescentibus bracteatis, calycis segmentis linearibus elongatis inæqualibus, corollæ tubo obconico, segmentis orbicularibus, staminibus in tubo inclusis.

Stems herbaceous, very slender. Leaves 1–2 in. long, thin, green and slightly pilose on both sides; petiole ⅙–⅓ in. Flowers few, arranged in a lax terminal raceme, the lowest branch sometimes forked; peduncles and pedicels densely softly glandular-pubescent; the latter with a pair of small opposite lanceolate bracts above the middle. Calyx ⅓–½ in. long, glandular-pubescent; tube very short. Corolla ⅝–⅞ in. long; segments 5, subequal, spreading, ¼–⅓ in. broad. Stamens inserted low down in the tube; anthers of the longer pair with a spur at the base of the larger cell.—*Baron* 3435! 4050! 4294! Very near *M. lanceolata*, Baker.

STROBILANTHES HISPIDULA, n. sp.

Fruticosa, ramulis gracilibus pilosis, foliis longe petiolatis integris acutis ovatis vel oblongis, floribus axillaribus solitariis, bracteis foliaceis oblanceolatis, calyce piloso tubo infundibulari dentibus lanceolato-acuminatis tubo æquilongis, corollæ tubo infundibulari segmentis 5 oblongis subæqualibus, staminibus didynamis antheris omnibus perfectis ovatis subæqualibus.

A much-branched shrub, with slender densely hispidulous branchlets. Leaves $1\frac{1}{2}$–2 in. long, rather thin, green and obscurely pilose on both surfaces, deltoid or rounded at the base; petiole $1–1\frac{1}{2}$ in. long. Flowers solitary in the axils of the close reduced upper leaves; bracts oblanceolate, obtuse, generally larger than the calyx. Calyx $\frac{1}{4}$ in. long, densely pilose. Corolla $\frac{3}{4}$ in. long; tube much dilated in the upper, cylindrical in the lower half; segments $\frac{1}{6}$ in. long, $\frac{1}{8}$ in. broad. Longer stamens reaching to the throat of the perianth-tube; anthers 4, small, ovoid. Ovary ampullæform; style reaching up to the anthers.—*Baron* 4543!

BARLERIA KITCHINGII, n. sp.

Fruticosa, inermis, foliis parvis ovatis integris hispidis, floribus dense spicatis sordide purpureis, calycis segmentis exterioribus magnis cordato-ovatis spinoso-marginatis demum scariosis, interioribus parvis lanceolatis, corollæ tubo deorsum cylindrico sursum infundibulari, limbi segmentis 5 orbicularibus, antheris anticis cum stylo ex tubo breviter exsertis, posticis brevissimis.

Stems slender, shrubby, terete, green, glabrous. Leaves at the flowering-time very small. Spikes dense, oblong. Calyx of 4 segments; two outer nearly an inch long, $\frac{1}{2}$ in. broad, hispid, scariose, persistent; two inner hidden by the outer, small, lanceolate-acuminate. Corolla-tube $1\frac{1}{4}$ in. long, $\frac{1}{3}$ in. in diam. at the throat; segments spreading, $\frac{1}{2}$–$\frac{3}{4}$ inch broad; expanded limb $1\frac{1}{4}$ in. in diam. Longer stamens just exserted from the throat of the corolla-tube; anthers oblong, $\frac{1}{8}$ in. long; shorter stamens inserted with the others near the base of the tube, not reaching above its middle; anthers small, globose. Betsileo-land.—*Baron* 257! 4048! Ibara country, *Kitching*! A near ally of *B. cristata*, L.

BARLERIA PHILLYREÆFOLIA, n. sp.

Fruticosa, inermis, glabra, ramulis gracillimis, foliis petiolatis ovatis vel oblongis acutis integris, floribus solitariis axillaribus, bracteis linearibus, calycis segmentis hispidis, exterioribus magnis lanceolatis, interioribus parvis rigidulis, corollæ tubo infundibulari segmentis obovato-cuneatis, staminibus anticis ex tubo longe protrusis, posticis parvis staminodio æquilongis.

An erect shrub, with slender terete woody branchlets. Leaves $1\frac{1}{2}$–2 in. long, membranous, green and obscurely pilose on both surfaces, deltoid at the base; petiole $\frac{1}{4}$–$\frac{1}{3}$ in. long. Flowers solitary in the axils of many of the leaves; pedicel very short; bracts

linear, falcate, $\frac{1}{4}$ in. long. Outer calyx-segments leafy, lanceolate, $\frac{1}{2}$ in. long; inner shorter, narrower, firmer. Corolla-tube $1\frac{1}{2}$ in. long, $\frac{1}{3}$ in. in diam. at the throat; segments subequal, 1 in. long, $\frac{1}{2}$ in. broad. Stamens inserted low down in the tube; larger anthers oblong, $\frac{1}{8}$ in. long; shorter stamens $\frac{1}{8}$ in. long, with ovate anthers and a small staminode between them.—*Baron* 4555!

HYPOESTES PHYLLOSTACHYA, n. sp.

Herbacea, ramulis gracilibus pubescentibus, foliis longe petiolatis ovatis integris membranaceis glabris, spicis elongatis floribus singulis folio sæpissime reducto bracteatis, involucro unifloro bracteis exterioribus lanceolatis obtusis, interioribus foliaceis, calyce parvo, corollæ rubellæ tubo involucro paulo longiore, limbo parvo.

An erect herbaceous perennial, with slender pubescent stems. Leaves $1\frac{1}{2}$–2 in. long, deltoid at the base, acute or obtuse, thin, green and glabrous on both surfaces; petiole 1–$1\frac{1}{2}$ in. long. Spikes long, lax, simple or forked at the base. Involucre cylindrical, pubescent, $\frac{1}{2}$–$\frac{5}{8}$ in. long. Calyx much shorter than the involucre. Corolla-tube $\frac{1}{2}$ in. long; lower lip $\frac{1}{4}$ in. long, cuneate, shortly 3-lobed. Stamens reaching to the tip of the corolla-limb.—*Baron* 4907! Also *Hildebrandt* 3444! Near *H. lasiostegia*, Nees.

HYPOESTES MICROPHYLLA, n. sp.

Fruticosa, ramulis dense pilosis, foliis parvis brevissime petiolatis lanceolatis integris pilosis rigidulis, capitulis dense spicato-paniculatis, involucro unifloro bracteis lanceolatis rigidulis acuminatis, calyce involucro breviore, corollæ tubo pubescente involucro duplo longiore, limbo involucro æquilongo labio inferiore trilobato.

An erect shrub, with slender virgate densely pubescent branchlets. Leaves $\frac{1}{2}$–1 in. long, subcoriaceous, entire, green and clothed with adpressed hairs on both surfaces. Flowers in terminal panicles, with dense ascending spicate branches. Involucre $\frac{1}{4}$ in. long; inner segments shorter. Corolla-tube $\frac{1}{4}$ in. long; limb half as long as the tube; lower lip cuneate, $\frac{1}{6}$ in. broad. Stamens $\frac{1}{6}$ in. longer than the tube. Capsule lanceolate, acute, glabrous. —*Baron* 4382! Near *H. saxicola*, Nees.

HYPOESTES CONGESTIFLORA, n. sp.

Fruticosa, ramulis gracilibus pubescentibus, foliis linearibus subsessilibus rigidulis uninerviis glabris, spicis axillaribus secundis dense congestis, involucro unifloro piloso bracteis elongatis exterioribus foliaceis interiori-

bus acuminatis, calyce involucro duplo breviore, corollæ tubo involucro æquilongo, limbo triplo breviore.

An erect shrub, with slender virgate densely pubescent branchlets. Leaves $1\frac{1}{2}$–2 in. long, $\frac{1}{4}$ in. broad, firm in texture, green and glabrous on both surfaces. Spikes nearly sessile, many-flowered, densely congested, short, secund. Involucre densely pubescent, $\frac{1}{2}$ in. long; bracts all lanceolate; inner much shorter and more acuminate than outer. Corolla-tube $\frac{1}{2}$ in. long; lower lip $\frac{1}{6}$ in. long. Stamens reaching nearly to the tip of the ligulate upper lip of the corolla.—*Baron* 3391!

HYPOESTES OBTUSIFOLIA, n. sp.

Fruticosa, ramulis gracilibus obscure pubescentibus, foliis petiolatis ovatis integris obtusis membranaceis glabris, floribus paucis terminalibus confertis, involucro brevi unifloro, calyce involucro subæquilongo, corollæ tubo cylindrico involucro 3–4plo longiore, limbo tubo triplo breviore, labio infimo cuneato trilobato.

An erect shrub, with slender green branchlets, thinly clothed with adpressed pubescence. Leaves 1–2 in. long, $\frac{1}{2}$–1 in. broad, thin, green and glabrous on both surfaces; petiole $\frac{1}{4}$–$\frac{1}{2}$ in. long. Flowers few, in terminal congested spikes, bracteated by reduced leaves. Involucre and calyx $\frac{1}{4}$ in. long. Corolla-tube about an inch long, glanduloso-pubescent; lower lip $\frac{1}{3}$ in. long, $\frac{1}{4}$ in. broad. Stamens a little exserted from the corolla-tube.—*Baron* 4890!

HYPOESTES ACUMINATA, n. sp.

Fruticosa, glabra, ramulis gracilibus tetragonis, foliis petiolatis oblongo-lanceolatis acuminatis subintegris, floribus laxe spicato-paniculatis, involucro unifloro bracteis lanceolatis acutis, calyce involucro breviore, corollæ tubo infundibulari involucro triplo longiore, limbo brevi.

An undershrub, glabrous in all its parts, with slender square branchlets. Leaves 2–3 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad, narrowed to the base, thin in texture, green and glabrous on both surfaces, penninerved, with 8–9 pairs of arcuate erecto-patent main veins; petiole $\frac{1}{4}$–$\frac{1}{3}$ in. long. Spikes lax, ascending, peduncled, few-flowered. Involucre $\frac{1}{4}$–$\frac{1}{3}$ in. long; inner and outer bracts similar in length and shape. Corolla-tube 1–$1\frac{1}{4}$ in. long, white or reddish; lips under $\frac{1}{4}$ in. long. Anthers just exserted from the corolla-tube. —*Baron* 3407! 3513!

HYPOESTES SESSILIFOLIA, n. sp.

Fruticosa, glabra, ramulis gracilibus tetragonis, foliis sessilibus oblongis

subintegris, floribus dense unilateraliter spicato-paniculatis, involucro unifloro bracteis rigidulis lanceolatis acutis, calyce involucro paulo breviore, corollæ tubo involucro 2plo longiore, limbo involucro æquilongò.

An undershrub, glabrous in all its parts, with slender square green branchlets. Leaves 1–2 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad at the middle, obtuse, narrowed to the base, obscurely undulated on the margin, green and glabrous on both surfaces, moderately firm in texture, penninerved, with 6–8 pairs of arcuate-ascending main veins. Spikes short, dense, secund, stiffly erecto-patent. Involucre $\frac{1}{4}$ in. long, all the four bracts similar in size and shape. Corolla-tube $\frac{1}{2}$–$\frac{5}{8}$ in. long; lips $\frac{1}{4}$ in. long, the lower slightly 3-lobed. Anthers just exserted from the throat of the corolla-tube.—*Baron* 4284! Both this and *H. acuminata* are nearly allied to *H. jasminoides*, Baker.

HYPOESTES CHLOROCLADA, n. sp.

Fruticosa, ramulis gracilibus viridibus glabris, foliis petiolatis oblongis acutis integris acuminatis, floribus albidis vel rubellis spicato-paniculatis, involucro unifloro glanduloso-pubescente bracteis lanceolatis obtusis, calyce involucro breviore, corollæ tubo involucro 2–3plo longiore, limbo tubo triplo breviore.

A shrub, with slender green glabrous branchlets. Leaves 2–3 in. long, 1–1$\frac{1}{2}$ in. broad at the middle, narrowed gradually to both ends, bright green, glabrous. Flowers in a dense terminal panicle with spicate branches. Involucre pubescent, $\frac{1}{4}$ in. long. Corolla-tube $\frac{5}{8}$ in. long; limb $\frac{1}{4}$ in. long; lower lip cuneate, faintly 3-lobed. Anthers reaching halfway up the limb.—*Baron* 1224! 4045! 4893! Near *H. comorensis* and *H. jasminoides.*

CLERODENDRON (§ CYCLONEMA) MIRABILE, n. sp.

Erectum, fruticosum, glabrum, foliis oppositis sessilibus oblanceolato-oblongis acuminatis serratis, floribus parce corymboso-paniculatis, calyce tubo infundibulari dentibus magnis lanceolatis, corollæ tubo cylindrico longissimo, limbo parvo obliquo hispidulo.

An erect shrub, with slender terete stems. Leaves 3–4 in. long, 1–1$\frac{1}{2}$ in. broad at the middle, moderately firm in texture, green and glabrous on both surfaces, sharply incised in the middle half. Panicle sparse, terminal, erect; pedicels very short. Calyx $\frac{3}{4}$ in. long; teeth half as long as the tube. Corolla-tube half a foot long; limb seen in bud only, globose, with the stamens curled up so as to form a circle and a half, with oblong anthers.—*Baron* 4755! Near *C. macrosiphon*, Hook. f. Bot. Mag. t. 6695.

AJUGA OOCEPHALA, n. sp.

Perennis, caulibus decumbentibus simplicibus pilosis, foliis longe petiolatis ovatis obtusis profunde irregulariter crenatis utrinque parce hispidulis, floribus dense capitatis, pedicellis brevissimis, calyce tubo infundibulari dentibus lanceolato-deltoideis tubo brevioribus, corollæ tubo calyce paulo longiore, labio inferiore lobis lateralibus parvis oblongis centrale latissimo emarginato.

A perennial herb, with simple decumbent stems under a foot long. Leaves thin, 2–3 in. long, broadly cuneate at the base, green and thinly hairy on both surfaces; petiole $\frac{1}{2}$–1 in. long. Flowers in a dense terminal head, the lower whorls only bracteated by reduced leaves. Calyx $\frac{1}{6}$ in. long, hispid principally in the upper half. Corolla blue; tube $\frac{1}{3}$ in. long; lower lip $\frac{1}{4}$ in. broad. Stamens exserted $\frac{1}{8}$ in. beyond the throat of the corolla-tube.—*Baron* 3430! 3520!

INCOMPLETÆ.

CELOSIA (§ LAGREZIA) MICRANTHA, n. sp.

Annua, caulibus elongatis gracillimis obscure pilosis, foliis longe petiolatis ovatis vel oblongis obtusis basi cuneatis utrinque tenuiter pilosis, floribus in paniculam ramis primariis elongatis ramulis brevibus cymosis dispositis, perianthio segmentis oblongis albis utriculo brevioribus, utriculo lenticularo monospermo, stylo brevi, stigmatibus falcatis.

An annual, with very slender erect distantly leafy stems a foot long. Leaves 1–2 in. long, membranous, entire, green and thinly pilose on both surfaces; petiole as long as the blade. Panicles terminal, 1–3 in. long; branches pilose, ascending; cymes dense, few-flowered. Utricle green, globose, $\frac{1}{2}$ line long. Perianth-segments oblong, scariose, white, tinged with green.—*Baron* 4229! The three species previously known are characterized in 'Genera Plantarum,' vol. iii. p. 25.

PIPER (§ COCCOBRYON) EMIRNENSE, n. sp.

Glabrum, ramulis gracilibus, foliis longe petiolatis cordato-orbicularibus cuspidatis membranaceis e basi 7-nerviis, spicis axillaribus densissimis longe pedunculatis, bracteis orbicularibus peltatis, ovario globoso sessili, stylo brevi, stigmatibus 2 globosis capitatis.

Herbaceous, branched, with very slender elongated stems. Leaves 3–4 in. long, 2–3 in. broad, shallowly cordate, green and glabrous on both surfaces, with 7 main nerves, only the central three reaching beyond the middle; petiole $\frac{1}{2}$–1 in. long. Spikes in the fruiting-stage $\frac{1}{6}$ in. in diam. Peltate bracts minute. Style

nearly as long as the ovary, tipped with two spreading globose stigmas.—*Baron* 3677! Allied to *P. capense*, Linn. fil.

CRYPTOCARYA PAUCIFLORA, n. sp.

Ramosissima, ramulis gracillimis sursum ferrugineo-pubescentibus, foliis oblongis obtusis rigide coriaceis glabris facie viridibus dorso glauco tinctis, cymis paucifloris terminalibus et lateralibus, pedunculis pedicellisque dense ferrugineis, perianthio ferrugineo tubo obconico segmentis ovatis, antheris inclusis.

Branchlets crowded, ascending, slender, ferruginous only towards the tip. Leaves 1½–2 in. long, obtuse, deltoid at the base; veins fine, immersed; petiole ¼ in. long Cymes short, 3–4-flowered. Perianth ⅛ in. long; segments longer than the sulcate tube, both densely ferruginous. Stamens inserted at the throat of the tube, rather shorter than the segments. Ovary immersed in the perianth-tube. Fruit not seen.—*Baron* 4470!

OCOTEA (§ MESPILODAPHNE) TRICHANTHA, n. sp.

Ramosissima, ramulis dense pubescentibus, foliis erecto-patentibus breviter petiolatis oblongis obtusis rigide coriaceis basi cuneatis facie tenuiter dorso dense pubescentibus venis primariis valde ascendentibus, cymis axillaribus paucifloris, bracteis pilosis lanceolatis, perianthio dense piloso segmentis ovatis, calycis tubo accrescente rigido, fructu ex tubo breviter exserto.

Branchlets crowded, slender, erecto-patent, very pubescent. Leaves 1½–2 in. long, dull green on both surfaces, narrowed gradually from the middle to the base, with distant very ascending main veins. Cymes few-flowered. Cupule black, glossy, ½ in. long and broad. Fruit drab, ¾ in. long.—*Baron* 4373!

VISCUM GLOMERATUM, n. sp.

Aphyllum, ramosissimum, ramis primariis nodis compressis ad basin angustatis, ramulorum brevibus tetragonis, nodis cupulatis, floribus ad nodos glomeratis subsessilibus, ovario globoso rugoso, perianthii segmentis parvis ovatis.

Whole plant 3–4 in. long; lower internode of main stem ⅛–⅙ in. in diam., much compressed, much narrowed to the base; branchlets crowded, ascending, made up of several internodes ⅛–⅙ in. long, with cupular nodes enclosing a dense mass of minute flowers, of which there is also a cluster at the tip of each branchlet.—*Baron* 3757! On a *Eugenia*. Allied to *V. japonicum*, Thunb., and *V. capense*, L. fil.

VISCUM RHIPSALOIDES, n. sp.

Aphyllum, fruticosum, glabrum, ramis primariis teretibus lignosis, junioribus compressis erecto-patentibus viridibus subtiliter multisulcatis basi articulatis, nodis superioribus bracteis parvis oblongis carnosis oppositis præditis, floribus masculis axillaribus sessilibus segmentis ovatis tubo campanulato æquilongis.

A shrub, many times dichotomously, finally distantly pinnately branched; branchlets erecto-patent, $\frac{1}{8}$–$\frac{1}{6}$ in. in diam.; upper internodes $1\frac{1}{2}$–2 in. long. Upper nodes with two small spreading obtuse fleshy bracts a line long. Male flower $\frac{1}{12}$ in. in diam. Female flowers not seen.—*Baron* 4892! Resembles in habit the Indian and Cape *V. dichotomum*, D. Don.

THESIUM CYSTOSEIROIDES, n. sp.

Fruticosum, ramosissimum, siccitate brunneum, habitu *Cystoseiræ*, ramulis gracillimis glabris, foliis subulatis mucronatis, floribus solitariis axillaribus breviter pedicellatis foliis circiter 3 reductis bracteatis, ovario globoso pubescente perianthii segmentis conniventibus coronato.

A much-branched shrub, with glabrous stems and leaves, all turning brown when dried; main stems terete, $\frac{1}{12}$ in. in diam. Leaves scattered, ascending, $\frac{1}{6}$–$\frac{1}{4}$ in. long, tipped with a pale horny mucro. Fruit $\frac{1}{8}$ in. in diam., vertically ribbed, crowned with the green connivent deltoid perianth-segments, which are much shorter than the fruit.—*Baron* 3490! Habit of the Cape *T. ericæfolium*, A. DC.

PEDILANTHUS? LYCIOIDES, n. sp.

Fruticosus, glaber, ramis lignosis elongatis aculeis pungentibus rectis patulis armatis, ramulis brevissimis pulvinatis minute aculeatis, foliis sessilibus linearibus obtusis rigide coriaceis, involucris oblongis rubellis profunde bilabiatis ad ramorum apices glomeratis pedunculis pedicellisque dichotomis brevissimis, bracteis bracteolisque parvis ovatis, flore fœmineo unico stylis elongatis summo apice furcatis, floribus masculis pluribus.

Stem woody, cylindrical, a foot or more long, without branching, $\frac{1}{6}$ in. in diam., producing irregularly small prickly pulvini representing branchlets and armed with straight spreading pungent prickles $\frac{1}{4}$–$\frac{1}{3}$ in. long. Leaves sessile, deciduous, rigid, linear, obtuse, 1–$1\frac{1}{4}$ in. long, $\frac{1}{12}$ in. broad, distinctly costate, obscurely penninerved. Heads about 6 in a cluster at the ends of the main branches; peduncles dichotomously forked; each head clasped by a small ovate membranous bracteole. Involucre

$\frac{1}{4}$–$\frac{1}{3}$ in. long, composed of two unequal oblong lobes reaching down nearly to the base. Styles reaching in the flowering-stage to the tip of the involucre. Male flowers much shorter.—*Baron* 4772! 4792! This very curious plant merits further investigation. The genus *Pedilanthus* is exclusively American.

EUPHORBIA (§ ARTHROTHAMNUS) ALCICORNIS, n. sp.

Fruticosa, erecta, aphylla, multoties dichotomiter ramosa, ramulis strictis erecto-patentibus basi solum articulatis, capitulis ad ramorum apices glomeratis, bracteis parvis ovatis, involucro parvo campanulato, appendicibus 7–8 erectis cuneatis.

An erect leafless shrub many times dichotomously forked; main stems terete, $\frac{1}{6}$ in. in diam.; penultimate branchlets 2–3 in. long; ultimate shorter, subterete, $\frac{1}{8}$ in. in diam. Heads clustered at the tips of the branchlets; bracts ovate, minute. Involucre $\frac{1}{8}$ in. in diam., crowned by 7–8 erect small cuneate emarginate fleshy green appendages.—*Baron* 4875!

EUPHORBIA (§ GONIOSTEMA) ORTHOCLADA, n. sp.

Fruticosa, ramis carnosis cylindricis elongatis, foliis sparsis alternis sessilibus oblanceolatis obtusis subcarnosis, cymis terminalibus oligocephalis, involucro campanulato bracteis 2 foliaceis orbiculari-cuneatis stipato appendicibus 5 orbicularibus integris patulis prædito, ovario seminibusque lævibus glabris.

A shrub, with long cylindrical fleshy unarmed branchlets. Leaves placed all down the branches, erecto-patent, fleshy, $1\frac{1}{4}$–$1\frac{1}{2}$ in. long, $\frac{1}{2}$ in. broad. Heads arranged in dense cymes at the ends of the branches, each subtended by a pair of foliaceous bracts $\frac{1}{4}$ in. long. Involucre $\frac{1}{6}$ in. in diam. Fruit-carpels $\frac{1}{4}$ in. long. Seeds large, oblong-quadrate.—*Baron* 3555!

EUPHORBIA (§ GONIOSTEMA) BAKERIANA, *Baill. in Bull. Linn. Soc. Par.* p. 623.

Arborea, ramosissima, ramulis gracilibus teretibus lignosis, foliis ad ramorum apices subconfertis petiolatis oblongis cuspidatis subcoriaceis, cymis axillaribus oligocephalis, bracteis parvis foliaceis ovato-lanceolatis, involucro parvo campanulato appendicibus 5 patulis integris orbicularibus.

A much-branched tree, glabrous in all its parts, with slender terete branchlets. Leaves 1–$1\frac{1}{2}$ in. long, conspicuously cuspidate, firm in texture, green and glabrous on both surfaces, with few indistinct erecto-patent main veins. Cymes axillary, shortly

peduncled, composed of 2–3 heads, each subtended by a pair of foliaceous bracts as long as the involucre. Involucre $\frac{1}{12}$ in. in diam. Fruit and seeds not seen.—*Baron* 3763! 3769! 3842! Allied to *E. adenopoda*, Baill., and *E. erythroxyloides*, Baker.

EUPHORBIA (§ GONIOSTEMA) PACHYSANTHA, *Baill. in Bull. Linn. Soc. Par.* p. 623.

Arborea, ramosissima, glabra, ramulis lignosis, foliis ad ramorum apices confertis breviter petiolatis oblongis acutis membranaceo-carnosis, capitulis terminalibus sessilibus, involucro campanulato appendicibus 5 patulis lunatis integris stipitatis.

A much-branched tree, glabrous in all its parts, with much stouter branches and branchlets than in *E. Bakeriana*. Leaves 2–3 in. long, $\frac{3}{4}$–1 in. broad, narrowed to the base and apex, green and glabrous on both surfaces, with the indistinct distant erecto-patent main viens anastomosing in intramarginal arches. Heads solitary at the tips of the branchlets. Involucre, including the spreading dark-green fleshy appendages, $\frac{1}{3}$ in. in diam. Fruit and seeds not seen.—*Baron* 4437! Allied to *E. Bakeriana*.

EUPHORBIA (§ GONIOSTEMA) MANCINELLA, *Baill. in Bull. Linn. Soc. Par.* p. 623.

Arborea, ramosissima, glabra, ramulis gracilibus lignosis teretibus, foliis petiolatis oblongis acuminatis subcoriaceis venis faciei inferioris perspicuis erecto-patentibus inter marginem regulariter in arcubus anastomosantibus, cymis terminalibus oligocephalis, pedicellis brevissimis, bracteis parvis ovatis, involucro campanulato appendicibus 5 patulis integris transversaliter oblongis.

A much-branched tree, with slender terete woody branchlets, rough with the raised scars of the fallen leaves. Leaves 2–4 in. long, 1–1$\frac{1}{2}$ in. broad at the middle, very acuminate, deltoid at the base, moderately firm in texture, with fine parallel main veins anastomosing at the tip in regular arches. Cymes sessile, terminal. Involucre $\frac{1}{6}$ in. in diam., clasped by two small ovate bracts. Immature fruit globose, $\frac{1}{6}$ in. in diam. Styles falcate, forked at the tip.—*Baron* 4442! Allied to *E. adenopoda*, Baill.

ANTIDESMA BRACHYSCYPHA, n. sp.

Ramosissima, ramulis gracilibus pubescentibus, foliis breviter petiolatis oblongis vel oblongo-lanceolatis utrinque viridibus glabris in axillis foliorum haud scrobiculatis, racemis masculis laxifloris rhachide pubescente, pedicellis brevissimis, bracteis lanceolatis, calycis tubo brevi, segmentis ovatis, ovario rudimentario globoso, staminibus 2–3 conspicue exsertis.

Much-branched, with crowded branchlets, glabrous below the tip. Leaves $1\frac{1}{2}$–2 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. broad at the middle, obtusely acuminate, narrowed to the base, moderately firm in texture, green and glabrous on both surfaces. Male racemes about an inch long; rhachis slender, pubescent. Calyx $\frac{1}{12}$ in. in diam. Stamens generally 3, twice as long as the calyx.—*Baron* 4447!

Antidesma alnifolia, n. sp.

A. ramulis gracilibus sursum pilosis, foliis breviter petiolatis oblongis obtusis utrinque viridibus præter costam glabris in axillis venarum haud scrobiculatis, floribus masculis copiose laxe spicatis, calyce late campanulato segmentis ovatis, ovario rudimentario globoso, stylo brevi staminibus sæpissime 3 conspicue exsertis.

A tree with slender branchlets pubescent towards the tip. Leaves 2–3 in. long, 1–$1\frac{1}{2}$ in. broad, rounded at the base, entire, green and glabrous on both surfaces except the midrib, the distant arcuate slender main veins anastomosing by intramarginal arches. Spikes copious, axillary, shortly peduncled, 2–3 in. long. Calyx $\frac{1}{12}$ in. in diam., greenish, lobed about halfway down. Stamens $\frac{1}{12}$ in. long.—*Baron* 4666!

Antidesma arbutifolia, n. sp.

A. ramulis ferrugineo-pubescentibus, foliis breviter petiolatis oblongis obtusis subcoriaceis utrinque viridibus glabris in foliorum axillis haud scrobiculatis, floribus fœmineis breviter racemosis rhachide pedicellisque dense pilosis, bracteis ovatis, calyce late campanulato dense piloso, stylis 3 incurvatis ovario æquilongis.

A tree with straight woody branchlets, pubescent only towards the tip. Leaves 2–4 in. long, 1–$1\frac{1}{2}$ in. broad, rounded to the base, moderately firm in texture, green and glabrous on both surfaces, with fine erecto-patent parallel main veins anastomosing in intramarginal arches. Female racemes axillary, peduncled, an inch long; pedicels as long as the flowers. Calyx $\frac{1}{12}$ in. in diam., twice as broad as long; segments ovate. Ovary globose, pilose.—*Baron* 4062!

Croton vernicosus, n. sp.

Fruticosus, ramulis sulcatis dense ferrugineo-lepidotis, foliis breviter petiolatis lanceolatis integris coriaceis facie viridibus vernicosis dorso dense persistenter albido-lepidotis, spicis terminalibus laxifloris, floribus masculis pluribus, calyce dense lepidoto, tubo brevi, segmentis ovatis, petalis parvis oblongis ciliatis, staminibus 9–10, flore fœmineo solitario, ovario dense lepidoto, seminibus brevibus nitidis,

A much-branched shrub, with slender sulcate branchlets matted with dense ferruginous lepidote scales. Leaves 3–4 in. long, $\frac{5}{8}$–$\frac{3}{4}$ in. broad, acute, narrowed to the base, bright green and glossy above, white beneath mixed with ferruginous spots. Spikes $1\frac{1}{2}$–3 in. long, with a stiff very lepidote axis. Male calyx $\frac{1}{12}$ in. diam., lepidote like the branches and axis. Fruit $\frac{1}{4}$ in. long. Seeds drab, glossy.—*Baron* 4935! Allied to *C. argyrodaphne*, Baill.

CEPHALOCROTON CORDIFOLIUS, n. sp.

Fruticosus, ramulis gracilibus sursum stellato-pilosis, foliis longe petiolatis cordato-ovatis integris acuminatis utrinque stellato-pilosis, stipulis lineari-subulatis persistentibus, floribus fœmineis solitariis calycis segmentis magnis deltoideis laciniis elongatis pectinatis, floribus masculis parvis in capitulum globosum dispositis pedicellis dense pilosis, calyce piloso tubo brevi segmentis 3–4 obtusis ovatis vel oblongis, staminibus isomeris, ovario rudimentario piloso stylo brevi, stigmate polycephalo.

A shrub, with slender terete woody branchlets. Leaves 3–4 in. long, 2–3 in. broad, very acuminate, slightly pilose above, densely beneath; petiole 1–$1\frac{1}{2}$ in. long. Female flower shortly peduncled; segments 5, an inch long, ovate, bipinnate. Male flowers many in a head $\frac{1}{2}$ in. in diam.; pedicels longer than the flowers; calyx $\frac{1}{12}$ in. in diam. Stamens as long as the perianth; anthers globose; filaments glabrous.—*Baron* 4668! 4774!

MACARANGA (§ EUMACARANGA) RACEMOSA, n. sp.

M. ramulis elongatis lignosis nigrescentibus sursum pubescentibus, foliis breviter petiolatis erecto-patentibus oblongo-lanceolatis subcoriaceis facie parce dorso copiose lepidotis venis 10–12-jugis parallelis erecto-patentibus, floribus fœmineis in racemos copiosos axillares breviter pedunculatos dispositis, pedicellis erecto-patentibus, calycis segmentis ovatis, fructu globoso glutinoso-lepidoto monospermo.

Branchlets stiff, straight, a foot long, glabrous below the tip. Leaves 2–3 in. long, $\frac{3}{4}$–1 in. broad, obtuse, cuneate at the base, firm in texture, green above, drab beneath, with the raised parallel main veins distinct to the edge. Female flowers in copious erecto-patent shortly peduncled axillary racemes 1–$1\frac{1}{2}$ in. long; pedicel as long as the fruit, subtended by a lanceolate bract. Fruit $\frac{1}{6}$ in. in diam., tipped by the persistent subulate style. Seed black, smooth, filling up the whole fruit.—*Baron* 3654!

MACARANGA FERRUGINEA, n. sp.

Arborea, ramulis crassis resiniferis sursum ferrugineo-pubescentibus, foliis alternis petiolo supra basin inserto late ovatis repando-dentatis subcoriaceis, facie tenuiter dorso dense pubescentibus, floribus masculis in paniculas deltoideas axillares dispositis in axillis bractearum glomeratis, bracteis magnis ovatis laciniatis pubescentibus, calyce parvo piloso segmentis ovatis, staminibus paucis.

A tree, with robust woody branchlets, clothed towards the tip with ferruginous pubescence. Petiole 2–3 in. long, pubescent; blade 3–4 in. long and broad, obscurely cordate, with the petiole inserted $\frac{1}{4}$–$\frac{1}{2}$ in. above the base, repand, with small cusps at the tip of the lobes, moderately firm in texture, matted above when young, but only obscurely pubescent when mature, drab and densely pubescent beneath, with 5–6 pairs of erecto-patent veins. Female flowers and fruit not seen. Male flowers in axillary panicles about as long as the petiole, several clustered in the axil of an ovate pubescent laciniated bract $\frac{1}{4}$ in. long. Buds small, globose, densely pilose. Stamens about 3.—*Baron* 4395! The stems contain an abundant supply of resin, the nature of which needs investigation on fuller material.

CELTIS GOMPHOPHYLLA, n. sp.

Arborea, glabra, ramulis gracillimis lenticellatis, foliis petiolatis oblongis vel ovatis integris acutis deorsum longe inæquilateraliter cuneatis, floribus 1–2nis axillaribus, pedicellis erectis vel cernuis fructu longioribus, ovario ovoideo glabro, stylis brevibus falcatis.

A tree, glabrous in all its parts, with very slender lenticellate branchlets. Leaves 2–3$\frac{1}{2}$ in. long, 1$\frac{1}{4}$–1$\frac{1}{2}$ in. broad at the middle, moderately firm in texture, green and glabrous on both surfaces, generally oblique in the lower half. Flowers solitary or in pairs in the axils of some of the lower leaves of the branch; pedicels ascending, slender, $\frac{1}{4}$ in. long. Dried fruit ovoid, $\frac{1}{8}$–$\frac{1}{6}$ in. in diam.; style $\frac{1}{2}$ line long.—*Baron* 3697! Adds the genus to the Madagascar flora.

FICUS COCCULIFOLIA, n. sp.

F. ramulis gracilibus pubescentibus, stipulis parvis pubescentibus, foliis cordato-ovatis obtusis utrinque viridibus pubescentibus venis primariis 4–5-jugis erecto-patentibus, receptaculis parvis pilosis e ramis haud foliatis ortis fasciculatis basi bracteis ovatis pubescentibus imbricatis, pedicellis ascendentibus.

An erect tree, with slender pubescent branchlets. Petiole $\frac{1}{2}$ in. long; blade 3–4 in. long, 2–2$\frac{1}{2}$ in. broad at the middle, obtuse,

shallowly cordate at the base, thin in texture for the genus, green and finely pubescent on both surfaces; main veins distant and forked before they reach the edge. Receptacles produced copiously on short leafless branchlets, only seen in a young state, very pubescent, as are the bracts and ascending pedicels.—*Baron* 4660! 4965!

Ficus (§ Urostigma) phanerophlebia, n. sp.

F. ramulis foliiferis gracilibus teretibus scabris, foliis breviter petiolatis oblongis cuspidatis subcoriaceis utrinque viridibus facie scabris dorso subtiliter pilosis venulis omnibus pallidis exsculptis, receptaculis parvis globosis glabris scaberulis breviter pedunculatis, pedunculo minute bracteato.

Leaf-bearing branches slender, very scabrous. Petiole also rugose, $\frac{1}{2}$–$\frac{3}{4}$ in. long; blade 3–5 in. long, 2–2$\frac{1}{2}$ in. broad, deltoid or rounded at the base, moderately firm in texture, pale green beneath, with about 6 pairs of arcuate main veins, all the small veinlets distinctly raised. Receptacles $\frac{1}{4}$ in. in diam., produced from the leafy branches; peduncle $\frac{1}{6}$ in. long, minutely bracteated above the middle.—*Baron* 4474! Allied to *F. claoxyloides*, Baker.

Ficus pachyclada, n. sp.

F. ramulis foliiferis validis scaberulis, foliis longe petiolatis oppositis vel alternis cordato-orbicularibus rigide coriaceis utrinque viridibus scaberrimis dorso hispidulis venulis omnibus exsculptis, receptaculis globosis magnitudine mediocribus dense pubescentibus pedunculatis e ramis nudis ortis solitariis basi haud bracteatis.

Leaf-bearing branch $\frac{1}{4}$–$\frac{1}{3}$ in. in diam.; petiole erecto-patent, 2 in. long; blade 3–4 in. long and broad, conspicuously cordate, very rough on the upper surface, pale green beneath, with all the hispid veinlets raised. Leafless fertile branches more slender. Peduncle pubescent, erecto-patent, minutely bracteate. Receptacle globose, densely pubescent, $\frac{1}{2}$ in. in diam.—*Baron* 4496! Nearly allied to the Asiatic *F. hispida*, L. fil.

Ficus (§ Covellia) pulvinifera, n. sp.

F. ramulis gracilibus apice pubescentibus, stipulis parvis lanceolatis, foliis petiolatis cordato-ovatis acutis utrinque viridibus glabris venis primariis 7–8-jugis arcuatis, receptaculis magnis globosis e ramis foliatis ortis solitariis basi bracteis tribus parvis ovatis suffultis, pedunculo piloso ascendente receptaculo æquilongo.

A tree, with rugose woody branchlets, pilose when young. Petiole $\frac{1}{2}$ in. long; blade resembling that of *Populus basalmifera*,

3–4 in. long, shortly cordate at the base, bright green above, smooth and quite glabrous on both surfaces. Receptacle glabrous, $\frac{1}{2}$–$\frac{5}{8}$ in. in diam. Peduncle erecto-patent, pubescent, $\frac{1}{2}$ in. long.—*Baron* 3406!

FICUS (§ COVELLIA) SAKALAVARUM, n. sp.

F. ramulis gracilibus pilosis, stipulis parvis lanceolatis, foliis breviter petiolatis cordato-ovatis integris obtusis subcoriaceis utrinque viridibus facie scabris dorso pubescentibus venis primariis paucijugis erecto-patentibus, receptaculis magnis duris globosis glabris breviter pedunculatis basi bracteis parvis ovatis suffultis.

Flowering branches slender, sulcate, densely pilose. Petiole $\frac{1}{4}$–$\frac{1}{2}$ in. long; blade 2–3 in. long, $1\frac{1}{2}$–2 in. broad at the middle, shortly cordate at the base, bright green, glabrous and scabrous above, paler green and pubescent beneath, with 5–6 pairs of parallel erecto-patent main veins. Receptacles produced from stouter leafless branches, an inch in diameter, subtended at the base by three small ovate bracts; peduncle about $\frac{1}{4}$ in. long.—*Baron* 4885! Common in the Sakalava country. Native name *Adabo* or *Adabolahy*.

FICUS (§ COVELLIA) ALBIDULA, n. sp.

F. ramulis gracilibus pilosis, stipulis parvis lanceolatis, foliis distincte petiolatis anguste oblongis obtusis subcoriaceis glabris facie viridibus dorso albidulis venis primariis 6–7-jugis arcuatis, receptaculis magnis solitariis breviter pedunculatis e ramis foliatis ortis basi bracteis 3 parvis ovatis suffultis.

A tree, with slender branchlets, hairy only at the tip. Stipules $\frac{1}{2}$ in. long, equalling the petiole; blade 2–3 in. long, $\frac{3}{4}$–1 in. broad at the middle, obtuse, rather rounded at the base. Receptacles $\frac{5}{8}$ in. in diam., produced from the leafy branchlets; peduncle very short.—*Baron* 3525!

FICUS (§ COVELLIA) BOTRYOIDES, n. sp.

F. ramulis gracilibus scabris, stipulis lanceolatis, foliis longe petiolatis oblongo-lanceolatis acuminatis subcoriaceis utrinque viridibus glabris, venis primariis arcuatis 7–8-jugis, receptaculis magnis globosis e ramis haud foliatis ortis dense cæspitosis, basi bracteis tribus ovatis suffultis, pedunculis elongatis glabris.

A tree, with slender terete branchlets. Petiole 1–$1\frac{1}{2}$ in. long; blade 4–6 in. long, $1\frac{1}{2}$–$2\frac{1}{4}$ in. broad at the middle, very acute, deltoid at the base, moderately firm in texture, green and glabrous on both surfaces. Receptacles $\frac{1}{2}$–$\frac{5}{8}$ in. in diam., produced in

dense clusters; peduncles sometimes an inch long; bract small, ovate.—*Baron* 3803!

Ficus (§ Covellia) trichoclada, n. sp.

F. ramulis gracilibus pubescentibus, stipulis lanceolatis pilosis, foliis longe petiolatis oblongo-lanceolatis integris subcoriaceis utrinque viridibus glabris venis primariis arcuatis 8–10-jugis, receptaculis magnis globosis pubescentibus solitariis e ramis foliatis ortis, basi bracteis 3 parvis ovatis suffultis, pedunculis brevibus dense pilosis.

A much-branched erect shrub, with slender sulcate branchlets. Petiole $\frac{1}{2}$ in. long; blade 3–4 in. long, 1–1$\frac{1}{2}$ in. broad, subacute, rounded at the base, moderately firm in texture. Receptacles $\frac{1}{2}$–$\frac{3}{4}$ in. in diam., produced singly from the slender branchlets just below the leaves; peduncle $\frac{1}{4}$–$\frac{1}{3}$ in. long.—*Baron* 3547!

Pilea macropoda, n. sp.

Dioica, herbacea, glabra, caule simplici erecto, foliis oppositis æqualibus longe petiolatis oblongis acuminatis crebre subtiliter serrulatis membranaceis, floribus fœmineis in foliorum axillis dense glomeratis, perianthii segmentis ovatis obtusis inæqualibus, achenio ovoideo compresso duplo brevioribus.

Stems herbaceous, erect, simple, moderately stout, a foot long. Leaves 3–4 in. long, 1$\frac{1}{4}$–1$\frac{1}{2}$ in. broad, deltoid or rather rounded at the base, membranous, triplinerved, finely sharply serrated, especially in the upper half; petiole 1–1$\frac{1}{2}$ in. long. Flowers in sessile clusters, in the axils of the central leaves. Achene ovoid, glossy, pale drab, half a line long. Male flowers not seen.—*Baron* 4450!

Elatostema hexadontum, n. sp.

Dioicum, glabrum, caulibus cæspitosis simplicibus debilibus apice solum foliatis, stipulis magnis lanceolatis persistentibus, foliis breviter petiolatis oblanceolatis supra medium conspicue dentatis, floribus masculis in foliorum axillis glomeratis, bracteis magnis ovatis foliaceis, perianthio membranaceo globoso segmentis 4 inæqualibus linearibus, antheris 4 subsessilibus.

Stems slender, decumbent and then ascending, 3–12 in. long. Leaves 4–6 on a side, alternate, $\frac{3}{4}$–1 in. long, $\frac{1}{6}$–$\frac{1}{3}$ in. broad, dark green, membranous, slightly inæquilateral, with about six large teeth in the upper half or third, the lower half entire, with a vein just within the margin connecting the main veins. Flowers in a sessile cluster in the axils of the leaves. Bracts $\frac{1}{6}$–$\frac{1}{4}$ in. long, the outer sterile. Perianth a small membranous bag, with 4 unequal erect segments.—*Baron* 505! 4059! 4475!

MONOCOTYLEDONS.

DYPSIS POLYSTACHYA, n. sp.

D. foliis copiose pinnatis, rhachi compresso scabro, segmento terminali parvo bifido, pinnis multijugis lanceolatis integris acuminatis, spadicibus copiose pinnatis, spicis elongatis gracillimis rhachi glabro, floribus fœmineis petalis ovatis striatis, sepalis orbicularibus minutis, fructu oblongo parvo monospermo.

Stem and sheaths not seen. Leaf $\frac{1}{2}$–2 ft. long; rhachis flat on the face, clothed with drab furfuraceous ramentum; pinnæ arranged irregularly, the lower 9–10 in. long, $\frac{1}{2}$ in. broad at the middle. Spathe not seen. Inflorescence nearly a foot long; spikes very slender, 8–9 in. long. Female flower $\frac{1}{16}$ in. long; bract broad ovate; petals striated; sepals rigid, not striated. Dried berry $\frac{1}{4}$ in. long; pericarp very thin.—*Baron* 1287! Nearly allied to *D. pinnatifrons*, Mart.

DYPSIS HETEROPHYLLA, n. sp.

D. foliis superioribus vel omnibus simplicibus cuneatis profunde bifidis, inferioribus interdum simpliciter pinnatis pinnis lanceolatis integris acuminatis, vaginis imbricatis glabris, spathis parvis pedunculo arcte vaginantibus, spadicibus bifidis vel trifurcatis rhachi glabro sulcato, petalis ovatis striatis, sepalis orbicularibus imbricatis petalis triplo brevioribus.

Stem $\frac{1}{4}$ in. in diam. Leaves many, spaced out, erecto-patent; sheaths about 3 in. long; blade 6–9 in. long, consisting sometimes entirely of one deeply bifid end-segment, sometimes of a small bifid end-segment and many erecto-patent lanceolate acuminate pinnæ. Spathe cylindrical, about 2 in. long. Spikes 2–3 in. long; bracts and bracteoles minute, orbicular. Petals strongly ribbed, $\frac{1}{12}$ in. long; sepals very rigid, glossy, not striated. Fruit not seen.—*Baron* 486! Also *Lyall* 323! *D. forficifolia*, Noronha; Mart. Hist. Palm. iii. 180, 312, tab. 143. fig. 2, is similar to this in habit, but all the leaves are simple and deeply bifid and the inflorescence is copiously compound. Mr. Baron has also gathered this (1490) and *D. pinnatifrons*, Mart. Hist. Palm. iii. 180, 312, tab. 158. fig. 1.

DYPSIS RHODOTRICHA, n. sp.

D. foliis copiose pinnatis, segmento terminali parvo bifido, pinnis multijugis lanceolatis integris acuminatis, vaginis ferrugineo-pilosis, spadicibus simplicibus rhachi glabro, petalis ovatis striatis, sepalis orbicularibus striatis petalis triplo brevioribus, fructu oblongo semine solitario.

Stem $\frac{1}{4}$ in. in diam. Leaves many, spaced out, erecto-patent;

sheaths about 3 in. long, imbricated, densely clothed with fine red-brown hairs; blade 9–12 in. long; pinnæ erecto-patent, lanceolate, 2–3 in. long, $\frac{1}{2}$ in. broad at the middle, narrowed gradually to the acuminate point. Peduncle axillary, 4–5 in. long Spadix short, simple; rhachis slender, angled, glabrous. Petals $\frac{1}{12}$ in. long, ovate, strongly ribbed. Sepals orbicular, imbricated, also ribbed. Fruit oblique, oblong, $\frac{1}{2}$ in. long, with a thin pink pericarp and a single seed with white horny albumen. —Forests between Tamatave and Antananarivo, in wet clayey soil, *Dr. Meller*!, who also collected another species with copiously pinnate leaves, with short truncate leaflets, inciso-serrated at the oblique apex. This latter, he notes, is "used for thatching." The specimen is without flower or fruit.

Dypsis concinna, n. sp.

D. foliis copiose pinnatis, segmento terminali parvo bifido, pinnis multijugis parvis lanceolatis acutis haud laceratis, vaginis glabris, spathis angustis, spadicibus bifidis vel trifurcatis, petalis ovatis striatis, sepalis parvis suborbicularibus, fructu oblongo semine solitario.

Stem $\frac{1}{4}$–$\frac{1}{3}$ in. in diam. Leaves many, spaced out, erecto-patent; sheaths glabrous, imbricated, 3 in. long; blade 6–8 in. long; rhachis slender, 4-angled, minutely furfuraceous; side-leaflets very numerous, 2–4 in. long, $\frac{1}{4}$–$\frac{1}{3}$ in. broad, narrowed gradually to a long point. Peduncles axillary, erecto-patent, 3–4 in. long, clasped tightly by the spathe; spikes 3–4 in. long; rhachis angled, naked; bracts and bracteoles minute, orbicular. Petals $\frac{1}{12}$ in. long; sepals not striated, coriaceous, glossy, $\frac{1}{3}$ as long as the petals. Fruit oblong, rather curved, $\frac{1}{3}$ in. long; pericarp thin. Seeds conspicuously spirally ribbed; albumen horny, white.—*Baron* 1286! 3413! Also received from Mr. William Pool in the year 1876.

Dypsis Curtisii, n. sp.

D. foliis copiose pinnatis, segmento terminali parvo bifido, pinnis multijugis irregulariter dispositis lanceolatis integris longe acuminatis, spathis cylindricis, spadice simplici elongato, rhachi dense nigro-furfuraceo, sepalis orbicularibus striatis, petalis oblongis obtusis calyce triplo longioribus.

Leaf $1\frac{1}{2}$ ft. long; rhachis flat on the face, scabrous; pinnæ erecto-patent; leaves 6–7 in. long, an inch broad at the middle, narrowed to the adnate base and a long acuminate point. Peduncle above half a foot long, tightly clasped by the coriaceous spathe. Spathe simple, 8–9 in. long; slender axis densely clothed with

black furfuraceous ramentum. Male flower $\frac{1}{12}$ in. long. Petals oblong, obtuse, valvate, strongly ribbed. Sepals imbricated, glossy, coriaceous. Fruit not seen.—*Curtis* 116! Received from Messrs. Veitch in 1881. This resembles *D. pinnatifrons*, Mart., in the shape of the leaflets, but the inflorescence is unbranched.

PHLOGA POLYSTACHYA, *Noronha, in Thouars, Prod. Phytol. Madag.* p. 2 (name only)=Dypsis nodifera, *Mart. Hist. Palm.* iii. 312.

Leaves 2–3 ft. long, simply pinnate; rhachis compressed; end-segment formed of 2–4 confluent side-pinnæ, deeply bifid at the apex; upper and lower side-pinnæ single; central crowded into irregular whorls; pinnæ lanceolate, 6–8 in. long, an inch broad at the middle, narrowed gradually to the base and deflexed very acuminate apex. Spathe narrow, coriaceous, 4–5 in. long, tightly clasping the stout peduncle. Spadix copiously bipinnate; final branchlets very slender, curved, 6–8 in. long; flowers laxly disposed, usually solitary; bract broad, ovate; bracteoles minute, orbicular. Male flower $\frac{1}{12}$ in. long; petals ovate, valvate, strongly ribbed; sepals suborbicular, imbricated, $\frac{1}{3}$ as long as the petals; stamens 6, half as long as the petals. Female flower with shorter petals. Fruit oblong, $\frac{1}{6}$ in. long, brown in the dried specimens, green when young in the fresh state, red when mature; pericarp thin, fleshy; seed single; albumen horny.—*Baron* 508! Also *Meller*! *Parker*! and received from Hort. Linden as "*Areca madagascariensis*." Native name "*Ouvun*," teste Meller; given as "*Ou Van*" by Noronha, *loc. cit.*, and "*Anivona*" by Dr. Parker.

PANDANUS MONTANUS, *Bory*,=Sussea conoidea, *Gaudich. Atlas Bonite*, tab. 24.

Gathered in South Betsileo-land by the Rev. Mr. Rowlands, from whose specimen the following notes are made:—Leaves 4–5 ft. long, rigidly coriaceous, $1\frac{1}{2}$–2 in. broad at the base, tapering gradually to the point, closely margined with lanceolate erecto-patent small prickles. Peduncle woody, $\frac{3}{4}$ in. thick. Female head oblong-triquetrous, $\frac{1}{2}$ ft. long, 3 in. in diam. Drupe clavate, $\frac{3}{4}$ in. long. Structure as drawn by Gaudichaud.—*Baron* 4931!

PANDANUS DYCKIOIDES, n. sp.

P. caule lignoso ramoso, foliis dense rosulatis linearibus acuminatis rigidulis aculeis corneis magnis lanceolatis vel deltoideis marginalibus armatis,

capitulis sessilibus centralibus, masculo oblongo bracteis magnis ovatis intermixto, fœmineo solitario subgloboso floribus circiter 20, ovario ampullæformi uniloculari, stigmate peltato.

Woody main stem $\frac{1}{2}$ in., tuft-bearing branch $\frac{1}{4}$ in. in diam. Leaves 9–15 in. long, $\frac{1}{4}$–$\frac{1}{3}$ in. broad above the dilated base, firm in texture, closely ribbed; spines $\frac{1}{8}$–$\frac{1}{6}$ in. long, stramineous above the base. Male flowers almost hidden by the large ovate bracts. Female head about $\frac{1}{2}$ in. in diam., subtended and overtopped by 3–4 oblong-lanceolate bracts with closely minutely serrated edges. Ovary under $\frac{1}{4}$ in. long.—*Baron* 491! 3815! Allied to *P. pygmæus*, Thouars, Bot. Mag. tab. 4736.

Crinum (§ Platyaster) modestum, n. sp.

C. bulbo collo oblongo, foliis 6–8 linearibus glabris subpedalibus, pedunculo foliis subæquilongo, umbellis 5–6-floris, spathæ valvis 2 lanceolatis reflexis, ovario sessili, perianthii tubo cylindrico, segmentis lanceolatis patulis tubo brevioribus.

Neck of the bulb in the dried plant 2–3 in. long, 1 in. in diam. Leaves a foot long, $\frac{1}{2}$ in. broad low down, tapering gradually to the point, closely finely ribbed, scabrous on the margin. Peduncle a foot long, $\frac{1}{4}$ in. in diam. Spathe-valves $1\frac{1}{2}$ in. long. Flowers all quite sessile; perianth-tube very slender, 2 in. long; segments $1\frac{1}{2}$ in. long, $\frac{1}{3}$ in. broad at the middle, 10–12-nerved. Filaments distinctly shorter than the segments.—*Baron* 48! 4223! Allied to the East-Indian *C. humile*, Herbert, Bot. Mag. t. 2636.

Dioscorea cryptantha, n. sp.

Volubilis, caule gracillimo pubescente, foliis membranaceis pubescentibus pinnatim trifoliolatis, foliolis obovatis vel oblongis aristato-cuspidatis, spicis masculis 2–4nis densis brevibus, bracteis magnis ovatis cuspidatis membranaceis, perianthio oblongo tubo brevi segmentis oblongo-lanceolatis, pedicello dense piloso.

An herbaceous climber, with very slender obscurely pubescent stems. Petiole an inch long; leaflets 1–2 in. long, membranous, faintly pilose, green above, pale beneath; end-leaflets obovate, shortly stalked; side-leaflets oblique oblong, nearly sessile. Spikes 1–$1\frac{1}{2}$ in. long, shortly peduncled, 2–4nate, from leafy or leafless nodes. Bracts ovate, brown, membranous, $\frac{1}{6}$ in. long, quite hiding the flowers. Male perianth $\frac{1}{12}$ in. long, twice as long as the very hairy pedicel. Anthers ovoid, nearly sessile on the base of the segments. Female flowers and fruit not seen.—*Baron* 4658! A near ally of the Cape *D. crinita*, Hook. fil. in Bot. Mag. t. 6804.

ALOE (§ EUALOE) HAWORTHIOIDES, n. sp.

Acaulis, foliis circiter 30 lanceolatis parvis acuminatis dense rosulatis aculeis patulis albis deltoideis cuspidatis copiosis præditis, pedunculo elongato, floribus parvis dense spicatis erecto-patentibus pallide rubellis viridi vittatis, bracteis ovatis cuspidatis, perianthio tubo subnullo, segmentis oblongo-lanceolatis, genitalibus demum breviter exsertis.

Rosette under 2 in. in diam. Leaves $1\frac{1}{2}$ in. long, $\frac{1}{4}$–$\frac{1}{3}$ in. broad at the base, thin in texture for the genus, dark green, tapering gradually to a long point, furnished on the edge especially upwards with copious white horny spreading prickles, which are found also on the back in a less-developed condition. Peduncle $\frac{1}{2}$ ft. long, with a few empty bracts in the upper half. Spike 2 in. long, consisting of about 20 erecto-patent flowers; bracts $\frac{1}{8}$–$\frac{1}{6}$ in. long, pale, with greenish ribs. Perianth $\frac{1}{4}$–$\frac{1}{3}$ in. long; segments pale pink, with a distinct green midrib. Stamens just exserted.—*Baron* 3424! Allied to the Cape *A. aristata*, Haworth.

ANTHERICUM (§ DILANTHES) DIANELLÆFOLIUM, n. sp.

A. foliis vetustis basalibus in fibris copiosis dissolutis, productis elongatis linearibus glabris venis crebris exsculptis, pedunculo nudo subtereti elongato, racemo simplici, nodis inferioribus 2–3-floris, bracteis superioribus parvis ovatis, pedicellis brevibus medio articulatis, perianthio albo segmentis oblongis dorso laxe 5-nervatis, antheris magnis lanceolatis filamentis brevibus, stylo elongato scabro.

Root-fibres many, cylindrical. Leaves rigidly erect, $1\frac{1}{2}$–2 ft. long, $\frac{1}{4}$–$\frac{1}{3}$ in. broad, with a distinct midrib and 10–12 crowded ribs on each side of it; the margin scabrous. Peduncle stiffly erect, about as long as the leaves. Raceme 2–3 in. long; lower bracts long-pointed, from a broad base; upper ovate-cuspidate, $\frac{1}{12}$–$\frac{1}{8}$ in. long; pedicel shorter than the bract. Perianth $\frac{1}{2}$ in. long. Anther $\frac{1}{4}$ in. long, twice as long as the filament. Style finally exserted.—*Baron* 659! 4121! Nearly allied to the Cape *A. triflorum*, Ait.

CHLOROPHYTUM CHLORANTHUM, n. sp.

C. foliis dense rosulatis subpetiolatis lanceolatis membranaceis glabris, pedunculo gracili nudo foliis breviore, racemis paucis laxifloris, nodis inferioribus 2–3-floris, bracteis parvis acuminatis, pedicellis flore longioribus medio articulatis, perianthio parvo viridulo, segmentis angustis, antheris parvis, fructu latiore quam longo.

Root-fibres slender. Leaves 10–12 in a rosette, 8–9 in. long, $\frac{1}{2}$ in. broad at the middle, narrowed gradually to the point and

obscure channelled petiole; ribs about 12; margin transparent. Peduncle very slender, naked, $\frac{1}{2}$ ft. long. Racemes about three, 2–3 in. long; pedicels $\frac{1}{4}$–$\frac{1}{3}$ in. long; bracts $\frac{1}{12}$–$\frac{1}{6}$ in. long, acuminate from a deltoid base. Perianth $\frac{1}{6}$ in. long. Capsule of 3 acute few-seeded lobes each $\frac{1}{8}$ in. long and broad.—*Baron* 3825!

Cæsia subulata, n. sp.

C. foliis basalibus pluribus subulatis glabris, pedunculo gracili foliis breviore, racemis laxissimis paucifloris simplicibus, nodis omnibus unifloris, bracteis minutis lanceolatis, pedicellis elongatis apice articulatis, floribus cæruleis segmentis lanceolatis, genitalibus inclusis.

Leaves 10–12 to a rosette, $\frac{1}{2}$ ft. long, $\frac{1}{2}$ line broad low down, distinctly ribbed, firm in texture. Peduncle very slender, 7–8 in. long. Raceme about 4 in. long, 5–6-flowered; lower bracts $\frac{1}{4}$ in. long; lower pedicels $\frac{1}{2}$ in. long, deflexed after flowering. Perianth $\frac{1}{4}$ in. long, strongly twisted after flowering; segments $\frac{1}{12}$ in. long. Stamens $\frac{2}{3}$ as long as the perianth.—*Baron* 3524! Nearly allied to the Cape *C. Eckloniana*, Roem. & Sch.

Aneilema (§ Lamprodithyros) tenera, n. sp.

A. caulibus elongatis glabris, foliis oblongis acutis subpetiolatis membranaceis glabris, cymis paucifloris scorpioideis, axillaribus simplicibus vel furcatis pedunculo elongato deflexo, terminalibus paucis paniculatis, bracteis ultimis parvis ovatis, floribus parvis pedicellatis, sepalis oblongis viridibus membranaceis, petalis parvis.

Stems slender, erect. Leaves 5–6 in. long, $1\frac{1}{4}$–2 in. broad at the middle, narrowed to an acute point and a short narrowly winged petiole. Side-cymes with a deflexed peduncle $1\frac{1}{2}$–2 in. long. End-panicle of about 4 lax cymes; main bracts oblong or lanceolate; pedicel as long as the flower. Sepals $\frac{1}{8}$ in. long, oblong. Anthers oblong, white; cells parallel. Fruit not seen. —*Baron* 49! 4118!

Coleotrype Baroni, n. sp.

C. caulibus glabris elongatis, foliis oblongis acutis subpetiolatis glabris, vaginis laxis truncatis ore dense ciliatis demum ad laterem ruptis, cymis multifloris, sepalis lanceolatis pilosis, petalis cæruleis deorsum in tubum cylindricum coalitis, filamentis dense barbatis, antheris oblongis loculis parallelis.

Stems ascending, above a foot long. Sheaths above $\frac{1}{2}$ in. long. Leaves 3–4 in. long, 1–$1\frac{1}{2}$ in. broad at the middle, narrowed gradually to the blade. Clusters of flowers produced from the nodes all the way down the stem. Calyx $\frac{1}{4}$ in. long. Corolla-tube as

long as the calyx; segments cuneate, blue, $\frac{1}{6}$ in. long. Style reaching to the tip of the perianth-segments. Fruit not seen.—*Baron* 3877!

CLADIUM FIMBRISTYLOIDES, n. sp.

C. foliis basalibus multis elongatis distichis linearibus rigidulis, caulibus elongatis subteretibus foliis multis reductis præditis, spiculis parvis oblongis pedicellatis in umbellas laxas simplices vel compositas pedunculatas ad foliorum axillas dispositis, glumis rigidulis castaneis, 4 exterioribus parvis ovatis, interioribus fertilibus majoribus oblongis.

Basal leaves numerous, distichous, erect, firm in texture, $1\frac{1}{2}$ ft. long, $\frac{1}{6}$ in. broad. Stems about 3 ft. long, with one or more simple or compound umbels from the axils of the distant reduced leaves of the upper two-thirds. Spikelets $\frac{1}{6}$ in. long, composed of 4 small sterile ovate glumes and two longer oblong ones. Style and stamens protruded a little beyond the tip of the glumes.—*Baron* 4193! 4517 is probably a form of the same species from a drier soil. The inflorescence is much shorter ($\frac{1}{2}$ ft. instead of 2 ft. long), its bract-leaves much smaller, and the spikelets are longer ($\frac{1}{4}$ in. long), with 6–7 sterile ovate glumes instead of four.

CYPERUS (§ PYCREUS) MONOCEPHALUS, n. sp.

C. foliis basalibus et caulinis pluribus productis linearibus, caulibus elongatis gracilibus angulatis, spiculis pluribus lanceolatis in capitulum globosum sessilem dispositis, bracteis 3–4 linearibus elongatis, glumis 10–12-jugis ovatis albidis valde imbricatis, nucis obovoideis lenticularibus, stigmatibus binis.

Stems densely cæspitose, erect, slender, 1–$1\frac{1}{2}$ ft. long, with several short linear leaves produced from the base and lower quarter. Longer bracts 3–4 in. long. Spikelets 20 or more, arranged in a single sessile head, each $\frac{1}{3}$ in. long. Glumes $\frac{1}{12}$ in. long, ovate, whitish, with 3 ribs on the back. Stigmas protruded beyond the glume.—*Baron* 3640! Allied to *C. globosus*, All.

CYPERUS (§ EUCYPERUS) SUBÆQUALIS, n. sp.

C. foliis productis multis, caulibus gracilibus teretibus elongatis, umbellæ radiis multis omnibus simplicibus brevibus, bracteis parvis haud foliaceis, glumis 4–6-jugis ovatis obtusis brunneis valde imbricatis, nucis obovoideo-triquetris, stigmatibus tribus.

Proper leaves absent. Stems slender, stiffly erect, 3–4 feet long. Umbel of 30–50 crowded rays, all about an inch long; bracts small. Spikelets few or many in a head, $\frac{1}{8}$–$\frac{1}{6}$ in. long. Glumes under $\frac{1}{16}$ in. long, very convex on the back, bright brown

with a narrow green edge. Stigmas protruded a little beyond the glume.—*Baron* 3639! Allied to *C. æqualis*, Vahl.

CYPERUS (§ EUCYPERUS) PLATYCAULIS, n. sp.

C. foliis omnibus rudimentariis scariosis vaginantibus, caulibus dense cæspitosis elongatis applanatis, umbellæ radiis pluribus brevibus simplicibus vel parum compositis, bracteis parvis scariosis, spiculis parvis lanceolatis, glumis 6–8-jugis oblongis obtusis castaneis valde imbricatis, nucis obovoideo-triquetris, stigmatibus tribus.

Stems erect, densely tufted, 3–4 feet long, quite compressed, $\frac{1}{6}$ in. broad, sheathed in the lower foot by rudimentary brown leaves. Rays 20 or more, unequal, simple or slightly compressed, at most 1–1$\frac{1}{2}$ in. long. Spikelets few in each cluster, at most $\frac{1}{4}$–$\frac{1}{3}$ in. long. Glumes $\frac{1}{16}$ in. long, dark bright brown. Stigmas protruding a little beyond the glume.—*Baron* 4456! Allied to *C. æqualis*, Vahl.

CYPERUS (§ EUCYPERUS) DEBILISSIMUS, n. sp.

C. foliis omnibus rudimentariis scariosis vaginantibus, caulibus longissimis debilibus angulatis, umbellæ radiis 4–6 simplicibus bracteis paucis productis linearibus, spiculis 6–8 lanceolatis, glumis 6–8-jugis ovatis brunneis valde imbricatis, nucis obovoideo-triquetris, stigmatibus tribus.

Stems very slender, densely cæspitose, 3–4 feet long, with about three brown sheaths, the highest reaching up a foot above its base. Umbels of spikelets all simple, varying from sessile to peduncled, with stalks an inch long. Spikelets $\frac{1}{4}$ in. long. Glumes brown, much imbricated, $\frac{1}{12}$ in. long. Stigmas protruded beyond the glumes.—*Baron* 3374! Allied to *C. æqualis*, Vahl, and *C. Haspan*, L.

CYPERUS (§ EUCYPERUS) CUSPIDATUS, n. sp.

C. foliis 3–4 productis subbasalibus linearibus, caulibus gracilibus triquetris, umbellæ radiis 8–10 valde inæqualibus simplicibus vel parum compositis, bracteis 3–4 linearibus foliaceis inæqualibus, spiculis paucis digitatis lanceolatis, glumis 4–5-jugis ovatis cuspidatis castaneis valde imbricatis, nucis obovoideo-triquetris, stigmatibus tribus.

Leaves 3–4, produced from the base of the stem, linear, ascending, 5–6 in. long. Stem very slender, erect, about a foot long. Umbel very irregular, the longest branches about an inch long, some simple, some slightly compound. Spikelets at most $\frac{1}{4}$ in. long. Glumes dark brown, $\frac{1}{2}$ line long, narrowed suddenly to a distinct cusp.—*Baron* 3854! Allied to *C. dichrostachys*, Hochst. (*Hildebrandt*, 4016).

ARISTIDA (§ CHÆTARIA) MULTICAULIS, n. sp.

A. caulibus elongatis erectis strictis teretibus ramosis, foliis superpositis lineari-subulatis glabris rigidulis, spiculis permultis purpureis in paniculum amplam coarctatam ramis diu ascendentibus dispositis, glumis lanceolatis acuminatis arcte convolutis, florali in aristis tribus continuis longis scabris producto.

Stems stiffly erect, 3 feet long exclusive of the panicle. Stem-leaves 3–4, sheaths 3–4 in. long; blade ½–1 foot long, stiffly erecto-patent. End-panicle a foot long; those of the side-branches smaller; branches short, slender; lower many in a whorl. Spikelets, including the awns, about an inch long; central awn twice as long as the glumes, all the three slender and erect.—*Baron* 4279! 4298!

ROTBOELLIA GRACILLIMA, n. sp.

Dense cæspitosa, foliis basalibus subulatis gracillimis strictis erectis, caule simplici foliis 2–3 reductis prædito, spiculis in spicam elongatam dispositis, rhachi gracili glabro articulato sulcato, gluma sterili exteriore oblongo-lanceolata rigidula purpurea internodio æquilonga dorso rotundata lævia, glumis reliquis brevioribus membranaceis.

Nearly allied to *R. cæspitosa*, with which it quite agrees in general habit; but the leaves are even more slender, the stems longer and more leafy, the unexpanded spikes very slender and coloured purple, and the outer sterile glume rather longer and not ribbed on the back.—*Baron* 4457!

ROTBOELLIA CÆSPITOSA, n. sp.

Dense cæspitosa, foliis subbasalibus elongatis subulatis gracilibus strictis erectis, caule simplici folio reducto ad spicæ basin prædito, spiculis in spicam elongatam dispositis, rhachi gracili glabro articulato sulcato, gluma sterili exteriore oblongo-lanceolata erecto-patenti internodio æquilongo, reliquis brevioribus membranaceis.

Leaves and stems densely clustered, stiffly erect, the former 1–1½ feet long, pale green, glabrous, not more than ⅓ line in diam. Flowering-stems, spike included, shorter than the leaves, with a leaf clasping the base of the spike, which is 5–6 in. long. Internodes and outer glumes ⅙ in. long, the latter rigid in texture, pale green, erecto-patent when the flower expands, furnished with 3 lax ribs on the back.—*Baron* 4091! Allied to the North-American *R. campestris*, Nuttall.

DEYEUXIA EMIRNENSIS, n. sp.

D. caulibus gracilibus erectis, foliis caulinis paucis remotis linearibus gla-

bris, spiculis parvis pilosis pedicellatis in paniculam laxam elongatam ramis flexuosis gracillimis ascendentibus dispositis, glumis omnibus oblongo-lanceolatis æquilongis, florifera hyalina membranacea breviter aristata.

Stems rather above a foot long, panicle included. Stem-leaves 3–4, the central sheaths 2–3 in. long; blade linear, glabrous, spreading or ascending, under half a foot long. Panicle half a foot long, the ascending branches very slender and flexuous. Spikelets $\frac{1}{8}$ in. long, with a tuft of white hairs at the base inside; sterile glumes oblong-lanceolate, white with a green keel; flowering-glumes entirely hyaline, shortly awned.—*Baron* 4497! Adds this temperate genus to the Madagascar flora.

Diplachne aristata, n. sp.

D. caulibus elongatis teretibus erectis, foliis remotis linearibus firmis glabris utrinque conspicue nervatis, spiculis 5–6-floris dense pilosis in paniculam amplam densam ramis ascendentibus gracillimis dispositis, glumis sterilibus parvis scariosis oblongo-lanceolatis, glumis floriferis lanceolatis apice bifidis inter dentes aristatis.

Stems moderately stout, terete. Stem-leaves spreading, 6–8 in. long, $\frac{1}{4}$ in. broad, firm and thick in texture, flat, pale green on the face, darker green on the back, with numerous distinctly raised ribs on both sides. Panicle nearly a foot long, all the branches very slender and ascending, the lower remote, the upper crowded. Spikelets $\frac{1}{4}$ in. long, villose, with dense soft white hairs; sterile glumes subequal, erecto-patent, brown, scariose, $\frac{1}{12}$ in. long; flowers laxly alternate on the axis, erecto-patent; flowering-glume $\frac{1}{6}$ in. long, including the short ascending or squarrose awn.—*Baron* 4945! Allied to the Cape *D. andropogonoides.*

Vascular Cryptogamia.

Cyathea rigidula, n. sp.

C. frondibus amplis rigide subcoriaceis viridibus glabris, pinnis oblongo-lanceolatis rhachidibus inermibus facie pilosis dorso parce paleaceis, pinnulis lanceolatis ad costam pinnatis, segmentis tertiariis oblongis contiguis inciso-crenatis margine recurvatis, venulis furcatis 6–8-jugis, soris densis costularibus, indusio parvo campanulato ore truncato.

A large tree-fern, with the habit of *C. arborea*, rigid in texture, green on both surfaces. Rhachides of the pinnæ and pinnules minutely paleaceous. Pinnæ above a foot long, $3\frac{1}{2}$–4 in. broad; pinnules very numerous, spreading, $\frac{1}{3}$ in. broad, cut down to the midrib into crowded ascending segments $\frac{1}{12}$ in. broad. Veins

very distinct. Sori filling all the segments except the edges and tips, often 8–10 to each. Indusium not more than half the size of the globose sorus, persistent, quite entire and truncate at the throat.—*Baron* 3845 !

CYATHEA LEPTOCHLAMYS, n. sp.

C. frondibus amplis bipinnatis utrinque viridibus facie glabris dorso parce piloso-paleaceis, pinnis oblongo-lanceolatis rhachibus inermibus facie dense pilosis dorso subcalvatis, pinnulis lanceolatis sessilibus sursum crenatis deorsum ad medium pinnatifidis segmentis contiguis oblongis, venis parce pinnatis, venulis 3–4-jugis ascendentibus simplicibus, soris ad pinnularum costam utrinque laxe uniseriatis, indusio membranaceo fragili.

A large tree-fern, allied to *C. canaliculata*, Willd. Fronds moderately firm in texture, green on both surfaces, paleaceo-pilose on the main ribs beneath. Pinnæ above a foot long, $2\frac{1}{2}$ in. broad. Pinnules very numerous, alternate, sessile, but not adnate, $\frac{1}{3}$ in. broad, the largest cut halfway down to the rhachis into contiguous ascending oblong lobes $\frac{1}{12}$ in. broad. Veinlets not more than 3–4 on a side opposite each lobe, distinct, simple, very ascending. Sorus one near the base of each lobe, a short distance from the midrib of the pinnule. Indusium membranous, persistent, $\frac{1}{16}$ in. in diam., breaking up irregularly; receptacle large, barrel-shaped, glabrous.—*Baron* 3665 !

POLYPODIUM (§ PHEGOPTERIS) BARONI, n. sp.

P. frondibus amplis bipinnatis utrinque viridibus glabris, rhachidibus furfuraceis minute paleaceis, pinnis oblongo-lanceolatis, pinnulis lanceolatis brevissime petiolatis ad costam pinnatis, segmentis tertiariis lineari-oblongis crenulatis adnatis, venis pinnatis venulis 5–6-jugis simplicibus obscuris, soris submarginalibus demum confluentibus.

General habit like that of the phegopteroid forms of *Nephrodium villosum*. Rhachides thinly coated with ferruginous tomentum and furnished with a few small linear brown paleæ. Longest pinnæ in the specimen 9–10 inches long. Longest pinnules 2 in. long, $\frac{1}{2}$–$\frac{5}{8}$ in. broad. Lower tertiary segments $\frac{1}{8}$ in. broad, ascending, adnate at the base, with a distinct space between each; veinlets distant and indistinct. Sori placed at the tip of the veins, superficial.—*Baron* 3920 !

LYCOPODIUM XIPHOPHYLLUM, n. sp.

L. caulibus simplicibus erectis angulatis, foliis laxe dispositis lanceolatis firmulis nitide viridibus integris patulis vel subsquarrosis basi decurrentibus, sporangiis ad foliorum centralium axillas solitariis sessilibus.

Allied to *L. serratum* and *L. Hamiltonii.* Stem $\frac{1}{2}$ foot long, stiffly erect from a decumbent base, simple in the specimen seen, brownish, strongly angled, not hidden by the leaves. Leaves $\frac{1}{2}$ in. long, $\frac{1}{16}$ in. broad, acute, decurrent at the base, flat, bright green, moderately firm in texture, with a very distinct midrib. Sporangia placed in the axils of entirely unaltered leaves, stramineous, reniform, a line broad.—*Baron* 4512!

Selaginella echinata, n. sp.

S. caulibus brevibus decumbentibus copiose bipinnatis, ramis ramulisque laxe dispositis erecto-patentibus, foliis densissimis distichis biformibus rigidulis pallide viridibus dense ciliatis apice acuminatis stramineis subpungentibus, planæ inferioris ovato-lanceolatis patulis, planæ superioris angustioribus ascendentibus squarrosis, spicis ignotis.

A very distinct species, intermediate in habit between *S. rupestris* and *S. denticulata.* Stems 2–4 in. long, with rootlets extending to the tip; branches of all grades alternate, distant, erecto-patent; ultimate branchlets very short; leafy branches $\frac{1}{8}$ in. in diam. Leaves firm in texture, grey-green, densely ciliated. Leaves of the lower plane very acuminate from an ovate base, $\frac{1}{12}$ in. long, with a distinct nearly central midrib. Leaves of the upper plane not much shorter, but narrower, ascending, and recurved. Fructification none in the specimens, but no doubt that of § *Stachygynandrum.*—*Baron* 4226!

Postscript.—Since the preceding pages were printed, the following description of a new species of *Chara* has been received from Messrs. H. and J. Groves.

Nitella Baroni, *H. & J. Groves*, sp. nov.

Habitus proxime *N. pseudo-flabellatæ.* Caulis ·4 millim. crassus. Ramuli verticillorum fertilium circa 8, similes, 3–4 furcati; radiis divisionis primæ plerumque 7, secundæ 5–6, tertiæ et quartæ 4. Segmenta primaria ramulorum totium longitudinem dimidiam æquantes. Segmenta ultima bicellularia, cellula inferiora ·05–·06 millim. crassa, superiora ·1 millim. longa, ·03 millim. crassa. Fructus solitarii, in divisione secunda aut tertia siti, ·53 millim. longa, ·4 millim. crassa, circa 9-striati, oospora ·34 millim. longa ·23 millim. crassa, liris inconspicuis, coronula brevi. Antheridia in divisione secunda.

Differs from *N. pseudo-flabellata* by the fruit and antheridia being separate, neither being produced at the first forking, and by the inconspicuous ridges of the oospore.—*Baron* 3420.

INDEX.

Abies amabilis, 170, 171, 172, 173, 174, 185, 192, 212; balsamea, 185; bifolia, 184; campylocarpa, 189; canadensis, 108; concolor, 177, 178, 179, 180; Fortunei, 196, 197, 198, 199; Gordoniana, 174, 180; grandis, 171, 172, 174, 175, 176, 180, 182, 184, 187, 212, var. densiflora, 171, var. Lowiana, 176, 177, 179, 180, var. pallida, 177, 179; hirtella, 195, 196; Kæmpferi, 208; Jezoensis, 197; lasiocarpa, 175, 180, 181, 182, 184, 185; Lowiana, 175, 180, 181, 182; magnifica, 173, 186, 187, 192, 193, 194; nobilis, 187, 188, 192, 193, 194, 212, var. glauca, 189, var. magnifica, 139, 190, 191; robusta, 191, 192, 193; Nordmanniana, 173; Parsonsiana, 175, 180, 181; pectinata, 108; religiosa, 194, 212; subalpina, 172, 183, 185, 186, 187.

Abronia arenaria (cotyledon), 371; umbellata (embryo), 370, 371.

Acacia decipiens, 106, 107; macracantha, 151; sp.? (Peru), 4, 151; tortuosa, 151; xiphoclada, 468.

Acæna, 15; lappacea, 37; sp.?, 37.

Acalypha indica, 338.

Acanthads (Naga Hills), 135.

Accumbent and incumbent cotyledons, 374.

Acer, 357; platanoides, 104; Pseudo-Platanus, 108, fruit and embryo, 362, seedling of, 351, 362, sect. of seed, 399, sessile cotyledon, 375, straight veins of, 341.

Aceranthus diphyllus, 432.

Achillea Millefolium, 107.

Achlys (Japan), 435; triphylla, 435, 436, 437, var. typica, 435, var. japonica, 435, 436, 437.

Achyranthes aspera, 338; velutina, 334.

Achyrocline satureioides, 44.

Achyrophorus elatus, = Hypochæris elata, 48; Lechleri, 165; Meyenianus, 48; taraxacoides. = Hypochæris taraxacoides, 48; tenerifolius, 165; tenuifolius, 165.

Acianthus petiolatus, 278.

Aconitum Napellus, 104; lycoctonum, 104.

Acrocryphæa (African), 311.

Acrostichum antrophyoides, 231; aureum, 231; bicuspe, var. integrifolium, 231; modestum, 231; quercifolium, 231; repandum, var. Quoyanum, 230; spicatum, 231; stenosemioides, 230; Wallii, 231.

Actæa spicata, 104.

Actinidia (Jakpho), 133.

Adabo or Adabolahy, native name for Ficus (Covellia) sakalavarum, 523.

Adiantum æthiopicum, var. = A. chilense, 63; Capillus-veneris, 224.

Ægopodium Podgraria, 104.

Æonia rosea, 122.

Æranthus Arachnites, 121, 122; Calceolus, 122; grandiflorus, 121, 122; polyanthemus, 121.

Æschynanthus, 135.

Æsculus Hippocastanum, 104, (ovule) 397.

Afzelia bijuga, 335, 337.

Ageratum conyzoides, 337.

Agrostis foliata, 59; nana, 58; virescens, 59.

Ailanthus glandulosus, 108, (seed) 364.

Ainsliæa (Jakpho), 133.

Ajuga, 441; oocephala, 514.

Akebia (Japan), 424; lobata, 425, var. *a.* clematifoliola, var. *β.* quercifolia, 425; quinata, 424.

Albizzia trichopetala, 468.

Alchemilla pinnata, 5, 37.

Alchornea, sp.?, 143.

Algæ (Diego Garcia), 340.

Alisma Plantago, 107.

Allium euosmon, 167; striatum, 167.

Alnus, 131.

Aloe arborescens, 111; aristata, 441.

Aloe (Eualoe) Haworthioides, 529.

Alonsoa acutifolia, 53; (Chicla) 5.

Alsophila Burbidgei, 222; contaminans, 222; latebrosa, 222; pruinata, 167; ramispina, 222.

Alstrœmeria aurantiaca, 110; peregrina, 56.
Alternanthera (Peru), 3.
Althæa (lobed cotyledon), 378.
Alyxia, 441; lucida, 503.
Amarantaceæ (Diego Garcia), 338; (Peru), 9, 55.
Amarantus caudatus, 106; chlorostachys, 55.
Amaryllideæ (Peru), 9, 56.
Ambrosia artemisiæfolia, var. peruviana, 45.
America, S.W., Botany of (Ball), 137.
Ampelocissus, sect. of Vitis, 460.
Amphorchis calcarata, 125.
Amphorocalyx, 476; multiflorus, 476.
Amsinckia angustifolia, 51.
Amygdalus communis, 104; persica, 104.
Anacalypta stellatifolia, 306.
Analysis Gen. & Sp. Gamopetalous Dicotyledons in Andean Flora, 18.
Anaphalis (Jakpho), 136.
Anchusa Kunthii, 51; leucantha, 51; linifolia, 51; oppositifolia, 51.
Andean flora, 18.
André, M., opinions regarding flora of Equatorial Andes, 6.
Andromeda speciosa, 104.
Aneilema (Kohima), 129; (Lamprodithyros) tenera, 530.
Anemone japonica, 104.
Angiopteris evecta, 231.
Angræcum Calceolus, 122; palmiferum, 121.
Anisothecium varium, 301.
Anivona, 527 (*see* Ouvun).
Anœctangium Mariei, 305; pusillum, 305.
Anomodon devolutus, 318; Toccoæ, 318.
Anona Cherimolia, 3; (germinating seedling), 387.
Anthemis Cotula, 165.
Anthericum (Dilanthes) dianellæfolium, 529; eccremorhizon, 56.
Anthocleista amplexicaulis, 506; rhizophoroides, 506.
Anthopterus (N. Granada), 147; mucronatus, 143; racemosus, 143; Wardii, 142.
Antidesma, 136; alnifolia, 519; arbutifolia, 519; brachyscypha, 518.
Antiphytum linifolium, 51; Walpersii, 51.
Antirrhinum junceum, 152, 153, 154; majus, 108; speciosum, 152.
Antrophyum parvulum, 230.
Apatales purpurascens, 245, 279.
Aphelexis flexuosa, 492; stenoclada, 493; sulphurea, 493.
Aphloia minima, 444.
Apium leptophyllum = Helosciadium leptophyllum, = Ammi leptophyllum, 41; Petroselinum, 105.
Apocynaceæ (Diego Garcia), 337.
Apodytes emirnensis, 458.
Apospory, distinctions of kinds, 440.
Apospory in Polystichum angulare, var. pulcherrimum (Druery), 437.
Apostasiaceæ, develop. inner row stamens, 415.
Aquilegia vulgaris, 110.
Aralia lætevirens, 167.
Araliaceæ (Naga Hills), 135.
Araucaria Bidwellii, 104; imbricata, 107.
Arauja serifera, 108.
Archidium africanum, 299; alternifolium, 299, 300; Ecklonii, 299.
Ardisia, 135; dissitiflora, 501; leptoclada, 500.
Areca madagascariensis, 527.
Arenaria Alpamarcæ, 31.
Argyreia (Nambre forest), 135.
Argyrobryum (African), 307.
Arica, plants around, 156.
Aristida (Chætaria) multicaulis, 533.
Arnottia, 116; inermis, 127.
Artemisia dracunculus, 111.
Arthrolobium, from Kilimanjaro, 299.
Arundina pentandra, 402.
Arundinella, 132.
Asarum europæum, 104.
Asclepiadeæ (Peru), 9, 17, 49.
Asclepias Curassavica, 104, 339; incarnata, 105.
Asophila glabra, 130.
Aspidium aristatum, 225; platanifolium, 225; semicordatum, 225.
Asplenium æquibasale, 225, 332, 335, 338; (§ Diplazium) æquibasale, 225; cordifolium, 225, var. integrifolium, 225; falcatum, 338; fragile, 64; Gilliesianum, 64; hirtum, 224; longissimum, 338; lineolatum, 225; macrophyllum, 224; maximum, 225; nidus, 338; nitidum, 225; pallidum, 225; polypodioides, 225; porphyrorachis, 225; porrectum, 225; trifidum (African), 299; triphyllum, 64; viride, 64.
Astephanocarpa arbutifolia, 493.
Aster chinensis, 105; pyrenæus, 106.
Asteropeia, 441; sphærocarpa, 479.
Astragalus Alpamarcæ, 36; casapaltensis, 36; Pickeringii, 36, var. serpens, 36; uniflorus, 36.
Athrotaxis cupressoides, 201; laxifolia, 200, 201; selaginoides, 201.
Athyrium, 130; Filix-fœmina, var. clarissima, 437, 440.

Atraphaxis spinosa, 106.
Atropa Belladonna, 105; biflora=Hebecladus biflorus, 53.
Aulacomnion, 306.
Auricled cotyledons, 390.

Baccharis alpina, 44, var. serpyllifolia, 44; (Andes), 21; cæspitosa, 44; Chilco, 44; Chilquilla, 159; confertifolia, 130, 158, 159; eupatrioides, 164; genistelloides, 44, var. alpina, 44; glutinosa, 160; lanceolata, 156; magellanica, 167; marginata, 159, 160; obovata, 44; parviflora, 159; (Peru), 3; sp., 44.
Baker, J. G., Collection of Ferns from N. Borneo, 220.
——, Flora of Madagascar, 441.
Balanophora elongata, 332; indica, 330, 331, 332; Thwaitesii (Trimen on), 330, 331, 332.
Balbisia (Peru), 13; verticillata, 34.
Balboa (Andes), 146.
Ball, J., Flora of Caldera, N. Chili, 158.
——, Flora of Payta, N. Peru, 148.
——, Flora of Peruvian Andes, 1.
——, Flora of Rimac Valley (Peru), 9, 28.
——, Notes on Botany of Western South America, 137.
Balsamineæ (Madagascar), 454.
Balsamodendron, 441; fraxinifolia, 459; laxiflora, 459.
Bambuseæ (Chiloe), 140.
Barbarea vulgaris, 106.
Barleria Kitchingii, 510; phillyreæfolia, 510.
Barnadesia, 14.
Baron, Rev. R., Madagascar Orchids, 116.
Barringtonia speciosa, 337.
Bartsia (Andes), 18; gracilis, 53; patens, 53.
Bazzania convexa, 322; decrescens, 322; deflexa, 322; pumila, 322.
Bean, embryo of, 348.
Beech (involucre), 401.
Begonia, 441; Baroni, 480; (Quadrilobaria) fragilis, 479; (Naga Hills), 135; hydrocotylifolia, 104; quinquifolia, 104.
Belbunium tuberculosum=Rubia tuberculosa, 42.
Belmontia, 441; emirnensis, 507.
Berberis Bealei, 428; latifolia, 428; (Japan), 426; Mariesii, 427; montana, 421; (ovule), 347; Sieboldi, 426, 427, 428; sinensis, 427; sp.?, 110; Thunbergii, 426, 427, var. β. Maximowiczii, 426, var. α. typica, 426; Tschonoskiana, 426, 427; vulgaris, var. japonica, 426, 427.
Beschorneria Tornellii, 111.
Betula alba, 104.
Bicornella parviflora, 123; gracilis, 125.
Bidens andicola, 45; bipinnata, 46; (Chicla), sp., 5; chilensis, 46; humilis, 45; macranthus, 45; (Peru), 3; pilosa, 46; tripartita, 106.
Bignonia insignis (cotyledon), 387.
Bignoniaceæ (cotyledon), 381; (Peru), 9, 13, 54.
Bishop of Singapore and Sarawak, Ferns of N. Borneo coll. by, 222.
Blechnum Finlaysonianum, 224; orientale, 224.
Bloom on Leaves and Distribution of Stomata (Darwin), 99.
Bloom, symbols used in, 104.
——, both surfaces leaf, 110.
——, either surface leaf, 104.
——, lower surface leaf only, 108.
——, upper surface leaf only, 109.
Blumenbachia carduifolia = Loasa carduifolia, 39.
Blyxa radicans, 236, 241; Roxburghii, 232, 233, 236, 237.
Bœckea, (ftnote) 220.
Boerhaavia diffusa, 338; viscosa, 3.
Bois Mapan, on Rose-tree, 333, 336.
Bolus, H., Contributions to S.-African Botany.—Orchideæ, Part II. With additional notes by N. E. Brown, 65.
Bomarea Caldasii, 110.
Bombaceæ, S.-Amer., 145.
Bonavia, Dr. E., Wild Source of Cultivated Limes, 213.
Bonplandia=Caldasia, (ftnote) 41.
Boottia abyssinica, 238, 239; cordata, 233, 240; crassifolia, 239; exserta, 240; scabra, 239.
Boragineæ (Diego Garcia), 337; (Peru), 9, 50.
Borneo, Ferns from (Baker), 222.
Borreria podocephala, 142.
Botany of W. S. America (Ball), 137.
Bourne, G. C., coll. plants from Diego Garcia, 333.
Bowlesia acutangula, 40; incana, 41; lobata, 40, var. chilensis, 40, var. humifusa, 40; palmata, 40; pulchella, 41.
Brachymenium (African), 306.
Brachythecium afrosalebrosum, 318; Dicksoni, 318; Knysnæ, 318; implicatum, 317; salebrosum, 318; vellerum, 318.

Brassica (cotyledon), 369; nigra, 345; oleracea, 110; Rapa, 105.
Braunia sciuroides, 310; indica, 310; Schimperi, 310.
Breweria tiliæfolia, 508.
Brexia madagascariensis, 104.
Broad cotyledons, 363.
Bromelia bicolor, 166.
Bromus auleticus, 63; frigidus, 63; Hænkeanus, 63; lenis, 63; tenuis, 63; unioloides, 63.
Broussonettia papyrifera, 104.
Brown, N. E., Orchideæ of S. Africa, (see Bolus), 65.
Brownleea, 116; cærulea, 127; madagascarica, 126.
Bryonia laciniosa (cotyledon), 375, 376, 385; dioica (seedling), 375, 376, 385.
Bryum alpinum, 307; argenteum, var. argyrotrichum, 307; capitulatum, 306; Commersonii, 307; coronatum, 307; flexifolium, 306; giganteum, 307; grandifolium, 307; integrifolium, 307; nipalense, 306; pulchrum, 306; roseum, 307; umbraculum, 307.
Buckwheat, seed of, 346.
Buddleia incana, 155; sphærocalyx, 505; sphærocephala, 505.
Bulbophyllum approximatum, 117; Baronii, 117; conitum, 119; coriophorum, 119; gracile, 118; (§ Bulbophyllaria) ophiuchus, 118; seychellarum, 117.
Bupleurum fruticosum, coriaceous leaves, 343; populifolius, 343.
Burmanniaceæ, develop. inner low stamens, 415.
Butea minor, 131.
Buxus sempervirens, 104.
Byrsocarpus Baroni, 462.
Byttneria Bauhinoides, 451; biloba, 451; heterophylla, 451; Melleri, 451.

Cacti of Peruvian Andes, 3.
Cæsalpinia Gilliesii, 156.
Cæsia subulata, 530.
Caladium, sp., 110.
Calandrinia, 15; acuulis, 32; caulescens, 32; sp.? (dwarf var. of caulescens), 32.
Calanthe crenata, 111; Masuca, 65; natalensis, 65; sylvatica, var. natalensis, 65.
Calceolaria, 15; bartsiæfolia, 53; biflora, 53; lobata, 53; ovata, 53; tenuis, 5, 53; virgata, 53.
Calceolariæ (Chicla), 5; (Peru), 4.
Caldasia, 15; (=Bonplandia), ftnote, 41; andicola, 41.
Caldera, Chili, flora of, 158.
Calendula officinalis, 106.
Callicosta (African), 309.
Calopyxis malifolia, 474.
Calycanthus, 392.
Calycifloræ (Madagascar), 462.
Calymperes Afzelii, 303, 304, 340; Dozyanum, 304; (§ Hyophilina) Garciæ, 339; ligulare, 303.
Calyptothecium africanum, 312.
Camellia japonica, 104.
Campanula persicifolia, 105; urticæfolia, 105.
Campanulaceæ (Peru), 9, 49.
Campylopus perpusillus, 301.
Canarium (ovule), 397.
Cantua (Andes), 20.
Capparideæ (Rimac), 9, 17, 30.
Caprifoliaceæ (Rimac), 9, 41.
Capsella Bursa-pastoris, 8, 29, 105; (Rimac), 5.
Capsicum frutescens, 339.
Cardamine chenopodifolia, 391.
Cardiopteris, 136.
Carex speciosa, 133.
Carlemannia (Naga Hills), 135.
Carpha paniculata, 168; Pervilleana, 483.
Carphalea, united with Dirichletia, 482.
Carpinus betulus, 105.
Carum carvi (cotyledon), 371, 398.
Caryophyllaceæ (cotyledons), 364; (Rimac, Peru), 9, 10, 30.
Cassia coquimbana, 161; floribunda, 108.
Cassytha filiformis, 338.
Castilleja fissifolia, var. pumilla, =pumila, 53.
Castor Oil, seed of, 348.
Casuarina equisetifolia, 338.
Casuarineæ (Diego Garcia), 338.
Catulpa Kæmpferi (seedling), 358.
Caulerpa mamillosa, 340.
Caulophyllum (Japan), 428; robustum, 422; thalictroides, 428.
Celosia (Lagrezia) micrantha, 514.
Celtis, 441; gomphophylla, 521; occidentalis, 105.
Centaurea melitensis, 8, 47; phrygia, 105.
Cephalandra, leaves entire, 341.
Cephalocroton cordifolius, 520.
Cephalophora litoralis, 161.
Cephalotaxus Fortunei, 201, 202; Mannii, 130; pedunculata, 201, 202, 203, var. sphæralis, 203, 212.
Cerastium arvense (seedling) 354, 365; glomeratum, 8, 31; vulgatum, 31.

Cerastium, narrow cotyledons, 344.
Cerasus Mahaleb, 105; vulgaris, 105.
Ceratanthe, 325.
Ceratocephalus falcatus, (seedling) 350.
Cereus Napoleonis, (seed) 371; (Peru) 3, 355.
Cespedesia (S. Amer.), 146.
Chælotropis andina, 58.
Chætanthera, 14.
Chætospora antarctica, 168; laxa, 168; rhyncosporoides, 168.
Chagos archipelago, coll. plants by G. C. Bourne, 333; Diego Garcia, an atoll, 333; flora of, 332; visited by, 333.
Chandonanthus fimbriatus, 322; hirtellus, 321; indicus, 322; javanicus, 322; rufus, 322; squarrosus, 322.
Chara, new sp. Madagascar, 537.
Cheilanthes crenata, =Woodsia obtusa, 63; Matthewsii, 63.
Cheiranthus Cheiri (accumbent cotyledon), 374, 375, 381; pygmæus (cotyledon), 398.
Cheirostylis gymnochiloides, 127.
Chelidonium majus, 110.
Chenopodiaceæ (Andes, Peru), 9, 55.
Chenopodiacearum sp., 160.
Chenopodium ambrosioides, 55; Bonus-Henricus, 106, 351, (seed) 361; seedling of, 351; cotyledon of, 350.
Chili, climate and veget. of, 139.
——, flora of Lota, 161; rainfall in, (ftnote) 161, 162.
Chirita acuminata, 135; pumila, 135.
Chlora perfoliata, 110.
Chlorophytum chloranthum, 529.
Chonos archipelago, climate and flora of, 140.
Choripetalum, 135.
Chrysanthemum Leucanthemum, 106.
Chuquiragua, 14; spinosa, var. inermis, 47.
Cineraria, 441; Anampoza, =Senecio Anampoza, 496.
Cissus Mappia, 335.
——, sect. of Vitis, 461.
Citrus acida, 213, 217, 218; acida, persistence winged petiole of. 213; Aurantium, 105, (cotyledon) 400; Hystrix, 214, 217, 218; limonum, 217; medica, 217, 218, var. acida, 213.
Cladium fimbristyloides, 531.
Cladophora demissa, 340,
Clarionea ciliaris=Perezia ciliaris, 47.
Clarke, C. B., Botanical Observations in Journey to Naga Hills, 128.
Clematis (Chicla), 5; Peruviana, 28; recta, (cotyledon) 398; viticella, 105.
Cleome chilensis, 30.
Clerodendron (Cyclonema) mirabile, 513.
Clidemia dependens, 141; hirta, 141.
Climatal relations to flora of W.S. America (Ball), 137.
Clitoria, 372, 375; ternatea (seedlings), 355; zanzibarensis, 466; var. of heterophylla, 465.
Clusia pseudomangle, 141; sp. ?, 141.
Clusieæ (Equator. Amer.), 146.
Clusiella (Andes), 146.
Cnicus eriophorus, 131.
Cobæa scandens, 108, (seed) 364.
Cochranea stenophylla, 161.
Codonocanthus, 135.
Codonopsis (Jakpho), 133.
Cœlogyne, 134.
Coffea (Naga Hills), 135.
Coldenia dichotoma, 151, 160; litoralis, 160.
Coleotrype Baroni, 530.
Colignonia biumbellata, 54; parviflora, 54; scandens, 54.
Collomia (Andes), 20; gracilis, 50.
Colombia, flora of Buenaventura in, 141.
Colura, 325, 329.
Combretaceæ (Diego Garcia), 337.
Commelina fasciculata, var. =C. nervosa, 56; (Kohima) 130, (Naga Hills) 130, (Peru) 9, 13, 56.
Commiphora, 441; fraxinifolia, 459; laxiflora, 459.
Comparisons plants, Weddell's 'Chloris Andina' and Rimac Valley (Ball), 16, 17.
Compositæ (Andes, Peru), 3, 9, 10, 13, 14, 16, 43, 392; (cotyledons) 364; (Diego Garcia) 337; (not recent) 21.
Concepcion, a doubtful plant locality, 157.
Conclusions regarding seedlings (Lubbock), 395.
Conformation of flower of Cypripedium, 402.
Conifers, history of certain species of (Masters), 169.
Conomitrum Metzgeria, 319.
Conostegia polyandra, 141.
Contributions to Study of Relative Effects different parts of Solar Spectrum on Transpiration of Plants, Rev. G. Henslow on, 81.
—— to Flora of Peruvian Andes, J. Ball on, 1.
—— to History of certain Species of Conifers (Masters), 169.

Convallaria majalis, 109, (ovules) 397.
Convolvulaceæ (Andes, Peru), 9, 51; (cotyledons) 381; (Diego Garcia) 337, (Jakpho) 134.
Convolvulus, 357; arvensis, 105; Soldanella (embryo), 381, 382; tricolor, 106.
Conyza amplexicaulis, 489; sophiæfolia, 44.
Coquimbo, plants of, 161.
Corchorus hamatus, 452.
Cordia, 392, (ovule) 397; subcordata, (crenate cotyledon) 336, 337, 373, 374; (seedling) 357.
Coreopsis auriculata, 366, 367; fasciculata, 45; filifolia, (achene and embryo) 366, (seedling) 350.
Coriifoliæ, sect. gen. Liparis, 257.
——, diagnosis, 257, 282.
——, key diag. spec. belonging to, 257–259.
Corydalis capnoides, 110.
Corylus Avellana (seed of nut), 397; foss. Mull, 219.
Cotula coronopifolia, 165.
Cotyledon bracteosum, 111; Chiclensis, 37; Incarum, 37.
Cotyledons and Leaves, forms of (Lubbock), 341, 349, 363; shape of no influence in form of seed, 345.
Cotyledons, 350, 363, 369, 372, 373, 378, 379, 385, 390; accumbent and incumbent, 374; auricled, 390; broad, 363; crenate, 373; divided, 385; emarginate, 379; lobed, 378; petioled, 375; size of, 394; unequal, 369; unsymmetrical, 372.
Crambe maritima, 110.
Crassula, 441; fragilis, 469.
Crassulaceæ (Andes, Peru), 9, 37.
Cratægus oxyacantha, 105.
Crawfurdia, 135.
Credneria, foss., 220.
Cremolobus aphanopterus, 29; parviflorus, 29; pinnatifidus = C. parviflorus = C. aphanopterus, 29; rhomboideus, 30; sinuatus, 30.
Crepis, 48; Lechleri, 165; virens, 165.
Cress, seedling of, 345.
Crinum capense, 111; erubescens, 143; Hildebrandtii, 339; (Platygaster) modestum, 528.
Cristaria foliosa, 156; seselifolia, 157; Spinolæ, 156; viridi-luteola, 157, 158.
Crotalaria luteo-rubella, 462; macropoda, 463.
Croton vernicosus, 519.
Cruciferæ (Rimac, Peru), 9, 10, 29.
Cruickshanks, coll. of plants from W. coast of S. America, 157.
Cruikshanksia hymenodon, 159; tripartita, 159.
Cryphæa concavifolia, 311; dentata, 311; incurvifolia, 311; julacea, 311; laxifolia, 310, 311; patens, 311; sphærocarpa, 311; Welwitschii, 311.
Cryptocarya pauciflora, 515.
Cryptomeria, foss. Mull, 219.
Cucurbitaceæ (Andes, Peru), 9, 39, 387.
Cultivated True Limes, wild source of, Dr. E. Bonavia on, 213.
Cunninghamia sinensis, 210.
Cuphea, 357, 379; silenoides, (sect. seed) 380, (stages growth seedling) 390.
Cuscuta chilensis, 51.
Cyathea Brunonis, 222; leptochlamys, 535; Lobbiana, 222; rigidula, 534.
Cyathodium africanum, 327; aureonitens, 327.
Cyclamen (cotyledon), 371.
Cyclea, 41; madagascariensis, 443.
Cymbidium bituberculatum, 263; clypeolum, 266; plantagineum, 287; (Kohima), 130; reflexum, 287; vexilliferum, 265.
Cynaroideæ, 14.
Cynoglossum revolutum, 51.
Cynosorchis angustipetala, 123; aurantiaca, 123; fastigiata, 154; flexuosa, 124; glandulosa, 123; grandiflora, 124; lilacina, 123, 124; speciosa, 122; tenella, 124; uniflora, 122.
Cyperaceæ (Colombia), 138; (Diego Garcia), 338; (Peru), 10.
Cyperus cuspidatus, 532; debilissimus, 532; ligularis, 338; Luzulæ, 144; (Pycreus) monocephalus, 531; platycaulis, 532; (Eucyperus) subæqualis, 531.
Cypripedium, 403, 404, 405, 407, 408, 410, 416; arietinum, 420; barbatum, 409, 411; candidum, 412, 418; caudatum, 419, 420; insigne, 417; Laurenceanum, 409, 410, 411, 412, 413, 417; Sedeni, 408, 409, 412, 414, 418; Spicerianum, 415; superbiens, 410, 411, 412; venustum, 409.
——, floral conformation of, 402; teratology of, 407.
Cyrtandraceæ (Naga Hills), 135.
Cystopteris fragilis, 63.
Cytisus Laburnum, 110; vulgare (seedling), 355.

Dacrydium Foncki, 168.
Dalbergia, 441; Poolii, 466; scorpioides, 466.
Dalea Mutisii, 36; onobrychis, 36.
Daltonia patula, 310.
Danais Lyallii, 481; nummularifolia, 481.
Daphne, 358; (Jakpho), 136; Mezereum, 108.
Darwin, F., Relation between "Bloom" on Leaves and Distribution of Stomata, 99.
Dasya cardicana, 340; crassipes, 340; indica, 340; stirposa, 340.
Datisca glomerata=Tricerastes glomerata, 40.
Datisceæ (Peru), 9, 13.
Daubeny's exper. heat-rays, 84; light on plants, 81.
Daucus torilioides, 41.
Davallia alpina, 224; parallela, 224; pinnata, var. luzonica, 224; solida, 224.
Decostea iodinifolia, 164; ruscifolia, 167.
Dehérain's researches on leaves, 82.
Delphinium, 348, 386, 393.
—— (seedlings) elatum, 356, 357, 375; nudicaule, 356, 357, (cotyledon) 376; Staphisagria, 356, 357, 375, (sect. seed) 394.
Dentaria (cotyledon), 398.
Deschampsia Mathewsii, 60.
Desfontainea (Chonos Archipel.), 140; spinosa, 166, 168.
Desmodium adscendens, 141; gyrans, 111; lespedegioides, 464.
Deyeuxia, 441; coarctata, 59; emirnensis, 533; Mandoniana, var. 59; sp. n., 59.
Dianthus barbatus, 105; broad cotyledons, 344, 351; caryophyllus (seedling), 354, 364, (seed) 365; deltoides, 105; Seguierii, 106; sp., 111.
Dichætanthera, 441, crassinodis, 476; oblongifolia, 477.
Dichondra repens, 51.
Dichronema setacea, 144.
Dichrostachys unijuga, 467.
Dicksonia adiantoides, 223; ampla, 223; gomphophylla, 223; (§ Patania) moluccana, 224; scandens, 224.
Dicoryphe, 441; Gualteriæfolia, 473; laurifolia, 474; retusa, 473.
Dicotyledons, foss. Mull, 219, 220.
Dicranum dichotomum, 300; Johnstoni, 300; majus, 301; Scoparium, 301.
Didymocarpus, 135, 441; pusillus, 508.
Didymochlæna polycarpa, 225.
Didymodon papillatus, 301.
Diego Garcia, vascular plants of, 337; vegetation (Hemsley), 332.
Dioscorea cryptantha, 528.
Diospyros, 131.
Diphylleia cymosa, 433, 434; Grayi, 433; (Japan), 433.
Diplachne aristata, 534.
Dirichletia involucrata, 482; ternifolia, 482; trichophlebia, 483; united with Carphalea, 482, 483.
Disa æmula, 69; affinis, 71; Bodkini, 74; Buchenaviana, 127; Cooperi, 71; cornuta, 69, 70; crassicornis, 70; incarnata, 127; lineata, 74; macrantha, 70; Melaleuca, 75; megaceras, 70; neglecta, 74; pygmæa, 72; reticulata, 73; Scullyi, 70; tabularis, 69; tenuicornis, 68.
Disperis Cooperi, 80; cucullata, 80; Macowani, 77, 80; namaquensis, 80; oxyglossa, 76, 80; paludosa, (ftnote) 77; purpurata, var. parviflora, 79; secunda, 80; stenoplectron, 80; Tysoni, 79, 80; tripetaloidea, 127; Wealii, 77, 80; Woodii, 78, 80.
Dissanthelium supinum, 61.
Distribution Indigenous species Nat. Ord. Plants coll. by J. Ball in Up. Valley Rimac, Peru, 9, 15.
Divided Cotyledons, 385.
Dobinæa (Kohima), 130.
Dodonæa viscosa, 400.
Dombeya acerifolia, 449; Baroni, 450; biumbellata, 450; floribunda, 449; Humboldtii, 449; lucida, 449; insignis, 450; megaphylla, 449.
Dorstenia indica (African), 249.
Draba siliquosa, 5, 29.
Drimys (Chonos Archipel.), 140.
Druery, T., on Apospory in Polystichum angulare, var. pulcherrimum, Wills., 437.
Drymaria cordata, 32; divaricata, 32; glaberrima, 32; leptoclados, 32, var. peruviana, 32; nitida, 31, 32.
Drymoglossum piloselloides, 230.
Dumasia, 135.
Dypsis, 441; concinna, 526; Curtisii, 526; forficifolia, 525; heterophylla, 525; nodifera=Phloga polystachya, 527; pinnatifrons, 525, 527; polystachya, 525, 527; rhodotricha, 525.

Echeveria (Chicla), 5.
Echinostrobus Sternbergii, 201.

Eden Harbour (Patagonia), plants from, 167.
Elæocarpus dalechampioides, 452.
Elæodendron gymnosporoides, 460.
Elasmium parviflorum, 296.
Elatostema hexadontum, 524.
Elettaria (seeds), 136.
Elynanthus laxus, 168.
Emarginate Cotyledons, 379.
Embelia, 135.
Embryo, size of, 393.
Encelia canescens, 160; canescens, var. parvifolia, 151, var. tomentosa, 160; farinosa, 151. 160; oblongifolia, 151; parvifolia, 151; (Peru) 3; tomentosa, 160.
Engler, views of plant-distrib. in S. America, 144.
Epallage dissitifolia, 494.
Ephedia americana = E. rupestris, 56.
Ephedra (root-membrane), 389.
Ephippianthus, 245.
Epicrisis, 41.
Epidendrum clypeolum, 266; labiatum, 297; monophyllum, 297; nervosum, 262; triandrous, 403.
Epilobium (Jakpho), 136.
Epimedium alpinum, 431, 432, 433, 436, 437, var. rubrum, 436; concinnum, 431; diphyllum, 430, 431, 432, var. humile, 430; (Japan), 430; japonicum, 432; longifolium, 433; macranthum, 430, 431, 432, 436, 437; var. β. Thunbergianum, 431, 436, var. α. typicum, 430, var. β. violaceum, 430, 431, 436; musschianum, 431, 433; paniculatum, 433; pruniflorum, 432; pumilum, 430; rubrum, 431, 432, 436; sagittatum, 432, 433; sinense, 430, 432, 433.
Equisetum (fossil), 219.
Eragrostis tephrosanthos, 61.
Erigeron (Andes), 18; canadensis, var. = E. crassicaulis, 44.
Eritrichium linifolium = Anchusa linifolia = A. oppositifolia = Antiphytum linifolium, 51.
Erodium, 378; Cicutarium, 8, 33; malacoides, 8, 33.
Erpodium coronatum, 313; Hanningtoni, 313, 314; japonicum, 314; Schweinfurthii, 313.
Erythrina cristata, 110.
Erythroxylum ampullaceum, 455; sparsiflorum, 455.
Eschscholtzia, 386, 387, 398; (forked cotyledons), 344, 357; californica (seedling), 359.
Eubryum (African), 307.
Eucalyptus, 357, 358; globulus (cotyledon), 377, 383; sp. (seedling), 358.
Eucryphæa (African), 311.
Eudicranum (African), 300.
Eugenia (Syzygium) aggregata, 475; apiculata, 163; Luma, 163; oligantha (Jossinia) 474.
Euhabenaria, 134.
Euhedwigia (African), 310.
Eulejeunea, 326.
Euloppia lurida, 121; macra, 120.
Eumeteorium (African), 314.
Euonymus (seed), 363.
Eupatorium Ballii, 43; Gayanum, 43; glechonophyllum, 164; glutinosum, 43; gynoxioides, 43; lavandulæfolium, 43; persicifolium, 43; salviæfolium, 43; sp., 43; Sternbergianum, 43.
Euphorbia (Africa), 299; adenopoda, 518; (Anthrothamnus) alcicornis, 517; (Goniostema) Bakeriana, 517, 518; Cyparissias, 110; erythroxyloides, 518; euonymoides, 518; Mancinella, 518; orthoclada, 517; pachysantha, 518; pilulifera, 338; serpens, 143.
Euphorbiaceæ (Diego Garcia), 338; (Naga Hills), 136; sp., 155.
Evodia floribunda, 457.
Exacums, 135.
Experiments in transpiration of plants (Henslow), 87, 89.

Fabronia Schimperiana, 316.
Fagonia aspera, 158; chilensis, 158; cretica, 158, 159.
Fagopyrum (cotyledon), 398.
Fagus antarctica, 168; betuloides, 168; Dombeyi, 168; (nut) 396; sylvatica, 105, (seedling) 352.
Ferns from N. Borneo (Baker), 222; of Diego Garcia, 338; of Naga Hills, 130.
Ferula (cotyledon), 349.
Festuca cacuminis, 62; casapaltensis, 62; livida, 62; mollis, 62; Myurus = F. muralis, 62; sp.?, 62; subuliformis, 62.
Ficus, 441; albidula, 523; benjamina, 105; botryoides, 523; cocculifolia, 521; cordata, 105; elastica, 105; pachyclada, 522; (Urostigma) phanerophlebia, 522; (Covellia) pulvinifera, 522; sakalavarum, 523; trichoclada, 524.
Filices (Andes, Peru), 63; (Diego Garcia), 338; (Peru), 9, 63.
Filipedes, sect. of Crassula, 470.

Fimbriaria Boryana, 328.
Fimbristylis glomerata, 338; polymorpha, 144, var. = F. laxa, 144.
First forms of leaves, 399.
Fissidens cellulosus, 319; dealbatus, 319; hyalinus, 319.
Flax (seed), 363.
Flora of Buenaventura in Colombia, 141; of Caldera, N. Chili, 158; of Lota (Chili), 161; of Madagascar (Baker), 441; of Naga Hills, 128, 131; of Payta, N. Peru, 148; of Peruvian Andes (Ball), 1.
Floral conformation of Cypripedium, Dr. Masters on, 482.
Fœniculum vulgare (seedling), 350.
Forms of first leaves, 399; of leaves and cotyledons (Lubbock), 341; of ovules (Lubbock), 345; of seedlings, and causes to which they are due, Sir J. Lubbock on, 341.
Fossil leaves from the Isle of Mull (Scotland) (Gardiner), 219.
Fotona, native name of Rhodolæna Bakeriana, 447.
Fox, Dr., Madagascar Orchids, 116.
Francoa sonchifolia, 163.
Franseria ambrosioides, 3.
Fraxinus excelsior, 105; (seed) 361.
Freshwater Hydrocharideæ of Africa (Ridley), 232.
Frullania angulata, 327; brunnea, 326; cordata, 326; Ecklonii, 326; emergens, 326; furcata, 241, 242, 243; hamata, 243; replicata, 327; squarrosa, 326; trinervis, 326; usagara, 326, 329.
Fuirena umbellata, 144.
Fungi (Diego Garcia), 340.

Galium, 357; Aparine, 8, 351, 384; (cotyledon), 367, 368, 369; (seedling), 384; boreale, 105; saccharatum, 351, 354, 367, 368, 369.
Galvesia, 152; juncea, 154; limensis, 154, var. grandiflora, 151.
Gambelia, 152; speciosa, 154.
Gamopetalæ (Peru), 10, 16, 18.
Gamopoda densiflora, 443.
Garcinia, 441; cauliflora, 446; cernua, 446; orthoclada, 446; polyphlebia, 446.
Gardenia succosa, 483.
Gardner, J. Starkie, Fossil Leaves from Isle of Mull (Scotland), 219.
Gastonia palmata, 105.
Gastroglottis, 245.
Gayac, a member of Leguminosæ, of Seychelles, Diego Garcia, &c., 336.
Gentiana (Andes), 18.
—— cruciata, 105; multicaulis, var., 50; prostrata, 50; sedifolia, var. casapaltensis, 49; vaginalis, 50.
Geraniaceæ (Madagascar), 441; (Naga Hills), 135; (Peru), 9, 13, 49; (Rimac), 33.
Geranium (cotyledon unsymmetrical), 372; bohemicum (germinating seedling), 377; Robertianum, 108; sanguineum (seedling), 355; sessiliflorum, 33.
Gerbera, 14; emirnensis, 498.
Germination, opinions thereon, 349.
Geum urbanum, 105.
Gilia (Andes), 20; laciniata, 50.
Ginkgo, foss. Mull, 219.
Girondia manicata, 105.
Glaucium, sp., 110.
Gleditschia triacantha, 105.
Gleichenia (Chonos Archipel.), 140; cryptocarpa, 167; flagellaris, 222; hirta, 222; pedalis, 167; vestita, 222.
Gnaphalium (Andes), 18; diffusum, 490; frigidum, 45; luteo-album, 8, 45; Mandonii, 45; melanosphæroides, 45; oxyphyllum, 45; piptolepis (=Merope piptolepis), 45; spicatum, var. (=G. sphacelatum), 45; ulophyllum, 161.
Gnetaceæ (Peru), 9, 55, 56.
Godoya (S. Amer.), 146.
Goldfussia glomerata, 105.
Gomphocalyx, 485; herniarioides, 486.
Goodenovieæ (Diego Garcia), 337.
Gossypium barbadense, 339.
Gramineæ (Diego Garcia) 338 (Peru), 9, 57.
Grammatophyllum Rœmplerianum, 122.
Gratiola officinalis, 105.
Gravesia, 441; porphyrovalvis, 477.
Grewia (foss. Mull), 219.
Grimmia leucophæa, 303.
Griselinia, 164; alata, 163; ruscifolia, 167.
Groves, H. & J., descrip. of new Chara from Madagascar, 537.
Guayaquil, Gulf of, climate and vegetation of, 138.
Guettarda speciosa, 334, 337.
Gymnogramme borneensis, 230; borneensis, var. major, 230; lobbiana, 230; quinata, 230.
Gymnosporia cuneifolia, 460.
Gynopleura rugosa, 159.
Gynura sonchifolia, 495.
Gypsophila perfoliata, 111.

Gyrinopsis (ovule), 397.

Habenaria arachnoidis, 124; conopodes, 124; cirrhata, 125; Foxii, 124; Hildebrandtii, 125; ichneumoniformis, 125; tenerrima, 125; truncata, 125.
——, numbers compared with Liparis, 246.
Haberlandt, distrib. & function of lenticels on branches, 100.
Hæmanthus (seed), 397.
Hakea, 357, 375, 390; acicularis (seedling), 354.
Halenia, 151; gentianoides, 50.
Halimeda Opuntia, 340.
Hallia Bojeriana, 464.
Hampea, 145, 146.
Hannington, Rev. J., coll. Mosses and Hepaticæ from Central Africa, 298.
Haplopappus hispidulus, 161; parvifolius, 161.
Hasseltia (N. Grenada), 146.
Hebecladus biflora=Atropa biflora, 53.
Hedera Helix, 105.
Hedwigia ciliata, 310; secunda, 310.
Hedychium coronarium, 134.
Hedysarum, 376.
Helleborus niger, 105.
Helianthoideæ, tribe of Compositæ, 495.
Helianthus annuus, 106; Cucumis (seed), 380.
Helichrysum amplexicaule, 491; araneosum, 491; farinosum, 491; platycephalum, 492; triplinerve, 492.
Helicodontium (African), 317.
Heliotropium parviflorum, 3, 50; peruvianum, 4.
Helminthostachys zeylanica, 231.
Hemicampylus (African), 330.
Hemitelia alternans, 222.
Hemsley, W. Botting, Report on Vegetation of Diego Garcia, 332.
Henslow, Rev. G., Solar Spectrum on Transpiration of Plants, 81; conclusions drawn, 98; in Adiantum, sp., 91; in Asplenium, 91; in Aucuba japonica, 91; in Box, 95; in Cactus, 96; in Coleus, 91; in Echeveria metallica, 96; in Euonymus japonicus, 91; in Euphorbia, 92; in Fern, 96; in Grass, 92; in Lettuce, 92, 93, 94; in Radish, 92; in Palms, 95; in Portugal Laurel, 90; in Pelargonium, 91; in Wallflower, 92.
Hepaticæ & Mosses from Central Africa (Mitten), 298.
Herberta dicrana, 322.
Heritiera macrophylla, 373.
Hernandia peltata, 338; ovigera, 338.
Herpestis Monniera, 337.
Herpetium deflexa, 322.
Hesperis matronalis (cotyledon), 370; (sect. seed) 374, 375.
Hexandrous Flowers, 414.
Hibiscus, 441; cytisifolius, 447; leaves entire, 341; nummularifolius, 448; oblatus, 448; tiliaceus, 336; xiphocuspis, 447.
Hieracium chiclense, 47; frigidum, 48; jubatum, 48; trichodonta, 48.
Hierochloa arenaria, 168; altissima, 168; antarctica, 168; antarctica, var., 168; magellanica, 168; redolens, 168; teretifolia, 168; utriculata, 168.
Hilsenbergia Baroni, 450.
Hippophaë, 375, 390; (embryo) 349; rhamnoides (seedling), 352, 363.
Hoffmanseggia viscosa, 150.
Hohnfeldt's observations stomata on leaves, 100.
Holmskoldia, 136.
Holothrix glaberrima, 116, 125.
Homalia elongata, 315; linguæfolia, 316; pulchella, sp. of Metzgeria on, 243.
Hooker, Sir J. D., Clarke's letter to, on Botany of Naga Hills, 128.
Hookeria angolensis, 309; Langsdorfii, 309; macropus, 309; Pappeana, 309; Utacamundiana, 309; versicolor, 309.
Hose, Dr., coll. Ferns from N. Borneo, 222.
Hottonia, subaqueous leaves, 343.
Huidobria chilensis, 159.
Humulus Lupulus, 108.
Hydnora (Kilimanjaro), 299.
Hydrangea hortensis, 105; quercifolia, 103, 105, 109.
Hydrilla rubella, 232; verticillata, 233, 236.
Hydrilleæ (African), 233.
Hydrocharideæ of Africa (Ridley), 232.
Hydrocharis, 99.
Hydrophyllaceæ (Andes, Peru), 9, 13, 20, 50.
Hymenophyllum (Chonos Archipelago), 140; dilatatum, 222; javanicum, 223; Neesii, 222.
Hyophila involuta, 304; javanica, 304; plicata, 304; Weisia, 304.
Hypericum calycinum, 110.
Hypnodendron Archeri, 313; arcuatum, 313.
Hypnum andongense, 316; arborescens 317; conostomum, 317; implicatum

317; salicicola, 317; Sprucei, 317; subcompressum, 317; toxarion, 317; usagarum, 317.
Hypochœris apargioides, 165; elata, 48; Lechleri, 165; radicata, 48; sessiliflora, 48; sp.?, 48; taraxacoides, = Oreophila taraxacoides = Achyrophorus taraxacoides, 48.
Hypoestes acuminata, 512, 513; chloroclada, 513; congestiflora, 511; microphylla, 511; obtusifolia, 512; phyllostachya, 511; sessifolia, 512.
Hypopterygium laricinum, 308.

Ilex Aquifolium, 105, 134; japonica, 423.
Imerina (Madagascar), Orchids of, 116.
Impatiens, 357; balsamina (seedling), 352; chinensis, 130; (Jakpho), 133; emirnensis, 454; Hildebrandtii, 454; parviflorum, 106; parviflora (sect. seed), 379; sultani, 299.
Incompletæ (Madagascar), 514.
Indigofera desmodioides, 463; ormocarpoides, 464; tinctoria, 463, 464.
Inuloideæ, 14; (tribe Compositæ), 493.
Ipomœa (Strophipomœa) biloba, 337; dasysperma, 357, 382, 383; grandiflora, 337; purpurea (embryo), 382; Pes-capræ, cotyledons of, 348; rubro-viridis, 507; (Orthipomœa) syringæfolia, 507.
Iridaceæ, develop. outer row stamens, 415.
Irideæ (Peru), 9, 56.
Isatis tinctoria, 106.
Isochilus, triandrous & five anthers, 403.
Isolepis pygmæa, 167.
Isotachis Auberti, 322.
Ixora pachyphylla, 484.

Jægeria hirta, var., 45.
Jakpho mountain, Botany of, 129, 132; as compared with Tonglo veget., 132.
Jasmine (ovule), 397.
Johnston, H. H., Mosses and Hepaticæ from Kilimanjaro, 298.
Juglans regia, 105.
Juncaceæ (Peru), 9, 57.
Juncus, 132, 133.
Jungermannia (African), Auberti, 322; convexa, 322; cupressina, 322; fimbriata, 321; hirtella, 321; minuta, 321; serrulata, 322; tripartita, 322.

Kalanchoe brachycalyx, 470; brevicaulis, 470; gomphophylla, 471; integrifolia, 471; (Kohima), 130; laxiflora, 472; multiceps, 470; pubescens, 470; pumila, 470; subpeltata, 472; (Kitchingia) sulphurea, 471; streptantha, 472.
Kalmia latifolia, 105.
Keteleeria, 199; Fortunei, 197.
Kissenia (Peru), 13.
Kitchingia, 441, 471, 472; laxifolia, 472; minuta, 473; streptantha, 472; sulphurea, 471; subpeltata, 472.
Kleinia Hildebrandtii, 498.
Koenigia (Jakpho), 136.
Kohima, vegetation of, 129.
Kùdalu dèhi, or Leech Lime of Ceylon, 213.
Kurz, Limes of Burma, 217.
Kyllinga monocephala, 338.

Labiatæ (Peru), 9, 54.
Laburnum, 357, (seedling) 355; vulgare (seed), 373.
Lactuca Scariola, 100.
Lagarosiphon cordofanus, 234; densus, 235; madagascariensis, 235; muscoides, 233, var. major, 233; Nyassæ, 234; Roxburghii, 232, 233, 236; rubella, 234; Schweinfurthii, 234; Steudneri, 234, 235.
Lanary, native name of Ochna macrantha, 458.
Landemy, native name of Anthocleista amplexicaulis, 506.
Lapageria rosea, 162, 166.
Larix conifera, 208; davurica, 211; europæa, 211; Kæmpferi, 208, 210.
Larkspur, seed of, 348.
Lasiopetalum ferrugineum (seedling), 400.
Lastrea apiciflora, var. non-apiciflora, 130; patentissima, 130.
Lathyrus pratensis, 109; sylvestris, 111.
Laurels (Jakpho), 134.
Laurineæ, (Chiloe) 140, 338; (Diego Garcia), 338.
Lavatera, 378.
Leaves, first forms of, 399; form determined by distance between buds, 342; forms of, and cotyledons (Lubbock), 341, 399; Grant Allen's views, division subæqueous leaves from paucity carbonic acid in water, 343; shape of, 341; venation, 341.
—— with bloom both surfaces (Darwin), 110; with bloom, lower surface only, 108; with bloom, upper surface only, 109; with no bloom on either surface, 104.
Lecontea farinosa, 486.
Leea cuspidifera, 461.
Leech Lime, 213.

Leguminosæ (Diego Garcia), 337; Kohima), 135; (Peru), 9, 10, 35.
Leioscyphus infuscatus, 321; Motleyi, 321; repens, 321.
Lejeunea acuta, 326; adhæsiva, 325, 329; atra, 324, 329; cornuta, 325; deplanata, 325, 329; digitalis, 325, 329; Hanningtoni, 324, 329; flava, 326; producta, 325; serrula, 324, 329; sinuata, 324, 329; subfusca, 324; superba, 325; tortuosa, 324.
Lemon Swangi, 216.
Leontice triphylla, 435.
Lepidium affine, 29; graminifolium, 389; ruderale, 106, 357; sativum, 345, (divided cotyledons) 344, (sect. seed) 389, 392, 397; virginianum, 8, 29.
Lepidopilum Hanningtoni, 309, 310; Lastii, 309.
Lepidothamnion, 168.
Lepidozia cupressina, 322.
Leptocolea, 325.
Leptodesmia congesta, 464.
Leptodon Smithii, 314, 323.
Leptodontium radicosum, 301; squarrosum, 301; stellatum, 301; tristichus, 301; Leschenaultii, 385; ignea, 385.
Leskea claviramea, 318; rubicaulis, 301.
Lespedeza, 130.
Leucopogon, (ftnote) 220.
Levisticum officinale, 106.
Liabum ovatum=(Paranephelium) uniflorum, 46.
Libocedrus tetragona, 168.
Light important in plant-growth, 81.
Ligularia racemosa, 133.
Liliaceæ (Peru), 9, 56.
Lilium speciosum, 105.
Lima, 213, 214, 216, 218; leaf, Ceylon, typical form of, 215; leaf, occasional form of, 215.
Lime, form of Indian, cultivated, 215.
Limes, Dr. Brandis on descent of, 213; wild source of cultivated sp. (Bonavia), 213.
Limo agrestris, 216, 218; Ferus, 216, 218; tuberosus, 216, 217, 218; tuberosus martinicus, 214, 216.
Limoen Swangi, 216.
Limonellus aurarius, 216, 218.
Linaria (caulicle), 395; vulgaris, 110.
Lindeniana, 265; lilifolia, 269.
Lindsaya cultrata, 224; cultrata, var. Lobbiana, 224; divergens, 224; lanuginosa, 224; scandens, 224; trapeziformis, 224.
Lindström on bloom-protected surface of Trifolium repens, (ftnote) 99.
Linum aquilinum, 162; flavum, 111; Macræi, 162; monogynum (seedling), 351, 353.
Liparis, anther-cap, 249; bracts, 248; capsule, 249; column, 249; diag. charac. gen., 252; distribution of, 246; divis. into sections, 251; excluded species, 297; fertilization, 250; flower of, 248; gen. founded by Richard, 244; habit of species, 245; insect attractions, 250; key diag. spec. belonging to, 253–257; leaves, 247; literature concerning, 244; nomina nuda, 297; relations of, 245; scape, 248; species dubiæ, 296; stem, rhizome, and pseudobulb, 246, 247; stigma, 249; the Mollifoliæ, 251, 253; the Coriifoliæ, 252, 257.
——, Monograph of Genus (Ridley), 244.
—— abyssinica, 254, 265; acutissima, 254, 264; affinis, 297; alata, 282, 297; anceps, 297; angustifolia, 246, 290; arnoglossophylla, 254, 268; atropurpurea, 247, 256, 277; auriculata, 254, 267, 294; aurita, 245, 249, 258, 291; barbata, 256, 276; Beccarii, 257, 284; Beddomei, 255, 268; Bernaysii, 297; bicornis, 253, 260; bidentata, 297; biloba, 256, 276; bistriata, 258, 288, 289; bituberculata, 253, 262, 263, 264; bituberculata, var. formosana, 263; bootanensis, 258, 285; Boottii, 293; Bowkeri, 250, 255, 270; brachyglottis, 256, 275; brachystalix, 247, 257, 281; bracteosa, 297; campestris, 254, 266; campylostalix, 255, 273; capensis, 255, 272; cæspitosa, 249, 258, 290, 297; chloroxantha, 257, 284; clavigera, 259, 294; clypeolum, 254, 266; cœlogynoides, 258, 286; compressa, 249, 258, 291; connata, 255, 270; correana, 272; crenulata, 120, 257, 283; crispifolia, 257, 280; Cumingii, 249, 258, 292; cuneilabris, 287; cuspidata, 254, 266; cylindrostachya, 297; decurrens, 249, 258, 291; decursiva, 287; dendrochilum, 259, 295; densiflora, 297; diodon, 257, 285; disepala, 248, 254, 265; disticha, 249, 250, 251, 258, 292; Eggersii, 256, 271; elata, 248, 249, 253, 259, 261, 262, 265; elata, var. rufina, 260; elata, var. inundata, 260; elata, var. latifolia, 260; elegans, 293, 294; elegantissima, 297; elliptica, 249, 250, 254, 265, 268, 289; ferruginea, 254, 264; flaccida, 249, 259, 296; flavescens, 120, 248,

257, 271; foliosa, 287; Forbesii, 249, 257, 283; formosana, 263; galeotiana, 265; Gerrardi, 255, 275; glossula, 254, 268; grandiflora, 248, 257, 282; gregaria, 292; Griffithii, 258, 285; grossa, 258, 288; guineensis, 253, 260, 261; Guingangæ, 256, 274; habenaria, 260; habenarina, 253; hawaiensis, 254, 267; Hookeri, 258, 288; intermedia, 297; jamaicensis, 265; japonica, 256, 273; Jovis-Pluvii, 256, 276; Kappleri, 253, 261; Krameri, 255, 269; labiata, 297; lacerata, 257, 284; laciniata, 250; latifolia, 257, 281, 283; liliifolia, 244, 255, 268, 269; Lindeniana, 265; livida, 277, 278; Loeselii, 246, 249, 255, 267, 269, 271, 272, 273; longa, 254, 255; longicaulis, 120, 255, 270; longipes, 247, 248, 249, 250, 251, 259, 293, 294; longipetala, 255, 275; lutea, 256, 274; luteola, 246, 258, 289; Mannii, 258, 286; minima, 297; monophylla, 297; montana, 256, 277; mucronata, 292; nepalensis, 246, 256, 278, 280; nervosa, 253, 262; neuroglossa, 249, 250, 257, 280; obcordata, 297; ochracea, 255, 270; odontostoma, 253, 263; odorata, 262, 264; olivacea, 254, 262, 263, 264, 277; orbicularis, 286; ornithorrhynchos, 249, 255, 270, 271; pallida, 296; paradoxa, 253, 260, 261, 262, 263, 264; parva, 256, 275; pachypoda, 288, 289; pachypus, 258, 288; parviflora, 259, 296; pectinata, 256, 277; pendula, 293; plantaginea, 258, 286; platyphylla, 254, 264; plicata, 257, 285, 286; polycardia, 255, 271; priochilus, 297; prionotes, 297; puncticulata, 119, 247, 255, 270, 272; purpurascens, 256, 279; pusilla, 259, 294, 295; ramosa, 257, 281; reflexa, 246, 250, 258, 270, 281, 284, 287; reflexa, var. β. cuneilabris, 287; repens, 247, 256, 279; resupinata, 245, 258, 290; revoluta, 258, 289; Rheedii, 251, 253, 261; rostrata, 268; rupestris, 254, 255, 268; rupestris, var. purpurascens, 268; Saundersiana, 248, 250, 256, 274; selligera, 286; serræformis, 297; spathulata, 247, 294; stachyurus, 259, 295; stenoglossa, 256, 279; Stricklandiniana, 259, 295; Tradescantifolia, 282; tricallosa, 255, 275; triloba, 259, 295; tristis, 297; vera, 251; vestita, 259, 294; viridiflora, 248, 258, 289; viridi-purpurea, 254, 267; Wageneri, 257, 281; Walkeriæ, 256, 277; Welwitschii, 247, 249, 257, 281; Wendlandii, 256, 274; Wightiana, 256, 278; Wightii, 289; xanthina, 256, 275; zeylanica, 297.

Lippia nodiflora, 338; reptans, 154.

List of Plants coll. in Upper Valley, Rimac, Peruvian Andes (J. Ball), 23.

List of Vascular Plants, Diego Garcia (Hemsley), 337.

Listera ovata, 250.

Litæas (Jakpho), 134.

Lithospermum (cotyledon), 385.

Loasa carduifolia, = Blumenbachia carduifolia, 39; Chilensis, 159; grandiflora, 39; xanthiifolia, 39

Loasaceæ, 9, 13, (Andes) 20, 26, (Peru) 39.

Lobed cotyledons, 378.

Lobelia Erinus, 101.

Lomaria tenera, 165; glauca, 130, 132; pycnophylla, 132.

Lonchocarpus Paullinioides, 466.

Lophocolea bidentata, 321.

Lopholejeunea, 324.

Loranthaceæ (seeds), 391.

Loranthus Eschscholzianus, 166.

Lota (Chili), flora of, 161.

Lubbock, Sir J., Phytobiological Observations, 341.

Luculia, 135.

Lugonia andina, 49; lysimachioides, 49.

Lupinus microphyllus, var. argyreas, 35; paniculatus, 4; paniculatus, var. argenteus, 35.

Luxembergiæ (Equator. Amer.), 146.

Luzula Alopecurus, 57; Chilensis, var., 57; = L. humilis, 57.

—— (Jakpho), 133; racemosa, 57, var. humilis, 57; spicata, 57.

Luzuriaga, 166.

Lychnis apetala, 30, 31; chilensis (= L. terminalis = L. nubigena), 31; chilensis, 30, 31, var. Peruviana, 30; magellanica, 31; thysanodes (= Silene thysanodes = S. andicola), 30; Viscaria, 106.

Lycopersicum Peruvianum, 52.

Lycopodiaceæ (Diego Garcia), 338.

Lycopodium cernuum, 144; scandens, 231; xiphophyllum, 535.

Lysionotus Griffithii, 135; ternifolia, 135.

Macaranga, 441; ferruginea, 521; (Eu-macaranga) racemosa, 520.

Maclura aurantiaca, 105.

Macrocoma (African), 305.

Macromitrium cæspitans, 305; confu-

sum, 305; Dawsoniomitrium, 305; Dregei, 305; Lycopodioides, 305; tenue, var brachypus, 305.
Madagascar, Flora of (Baker), 441; Orchids of (Ridley), 116.
Mæsa, 135.
Magellanic province, flora of (Ball), 140.
Mahonia Aquifolium, 105; japonica, 428.
Maianthemum bifolium, 105.
Malaxis affinis, 297; atropurpurea, 279; cæspitosa, 290; compressa, 291; cordifolia, 278; Correana, 272; crenulata, 283; disticha, 292; flavescens, 271; Galeottiana, 265; lancifolia, 261; Loeselii, 244, 274; longifolia, 272; minima, 297; montana, 277; mucronata, 292; odorata, 262; pallida, 296; parviflora, 296; purpurascens, 279; Rheedii, 261; Tradescantifolia, 282; viridiflora, 289.
Malesherbia humilis, 159; (Peru) 13; rugosa, 159; thyrsiflora, 39.
Mallostoma thymifolia = Hedyotis thymifolia, 42.
Mallow (embryo of), 378.
Malva, 378; moschata (seedling), 357, 358.
Malvaceæ, (Diego Garcia) 337; (Peru) 9; (Rimac, Peru) 32.
Malvastrum capitatum, 33; limense (=Malva limense), 32; peruvianum, 33; sp.?, 33.
Mammillaria, 161; Mandonii, 51; Walpersii, 51.
Manettia asperula, 142.
Maquenne, on evaporation and transpiration, (ftnote) 84.
Marsilea, 111.
Mascarenhaisia, 441; Gerrardiana, 504; macrosiphon, 504.
Masters, Dr. M. T., Contributions to History of Species of Conifers, 169.
——, Floral Conformation of Genus Cypripedium, 402.
Matisia (S. Amer.), 145, 446.
Maurandella, 153.
Maurandia juncea, 152, 153, 154.
Medicago denticulata, 8, 35; lupulina, 111.
Medinilla divaricata, 478; linearifolia, 478.
Melaleuca, (ftnote) 220.
Melastomaceæ, 475, 476, (Andes) 27; high antiquity of, 148; (Madagascar) 441.
Melica laxiflora, 60; sp.?, 60.
Melilotus indica, 8, (=parviflora) 35; officinalis, 111.
Melittis melissophyllum, (seedling) 353, (cotyledon) 393.
Melochia betsiliensis, 451.
Meniscium reticulatum, 144; Hosei, 230; Thwaitesii, 230; triphyllum, 230.
Menispermaceæ (Madagascar), 141.
Menispermum canadense (seedling), 353, 362.
Mentzelia hispida, 39; (S. America), 20.
Menyanthes trifoliata, 106.
Mercurialis (cotyledon), 393, 398; perennis, 105, 358.
Meteorium africanum, 314; imbricatum, 314.
Metzgeria, n. sp. of (Mitten), 241; myriapoda, 327; nitida, 243; saccata, 241, 242; scobina, 243.
Michelia (Jakpho), 133.
Miconia decussata, 142; reducens, 141; symplocoidea, 142.
Microglossa (Jakpho), 133.
Microloma (seedling), 357, 375.
Microstylis, 244; Bernaysii, 297; Commelynifolia, 282; japonica, 273; versicolor, 297.
Microthamnium frondosum, 316; fruticellum, 316; pseudoreptans, 316.
Mimosa myriocephala, 467; pudica, 110.
Mimoseæ (Peru), 151.
Mimulus glabratus, 53; luteus (seedling), 395.
Mimulopsis affinis, 509.
Mistletoe seed, 391.
Mitraria, Chonos Archipel., 140; coccinea, 168.
Mitten, W., Mosses and Hepaticæ from Central Africa, 298.
——, New Species of Genus Metzgeria, 241.
Mnium rostratum, 307.
Modica hederæfolia, 479.
Mollifoliæ, sect. gen. Liparis, diagnosis of, 253, 259.
Monadenia micrantha, 73; rufescens, 72.
Monnina crassifolia, 30; obtusifolia, 30; pubescens, 30; rotundifolia, 335.
Monochilus gymnochiloides, 127.
Monocotyledons, foss. Mull, 219; (Madagascar), 525.
Monograph genus Liparis (H. N. Ridley), 244.
Monopetalæ (of Madagascar), 480.
Morinda citrifolia, 337.

Morus alba, 105.
Moscharia pinnatifida (seed), 364.
Mosses (Diego Garcia), 339.
—— and Hepaticæ from Central Africa (Mitten), 298.
Mucuna (Nambre Forest), 135; (§ Stizolobium) axillaris, 465.
Muehlenbeckia rupestris, var. vulcanica, 55 = M. vulcana, 55; vulcanica, 55; rupestris, 55.
Muehlenbergia, 15; adspersa, 58; clomena, 58; sp.?, 58.
Mull, fossil leaves from (J. S. Gardner), 219.
Mundulea laxiflora, 464.
Musci (Diego Garcia), 339.
Mustard, seedling of, 345.
Mutisia, 14; lilicifolia, 165; viciæfolia, 47.
Mutisiaceæ, affinities, 14, 16; (S. America) 21, 26.
——, diff. lines descent of, Bentham and Ball's views, 14.
Myagrum (ovary), 397.
Myrioneuron, 135.
Myriophyllum, subaqueous leaves, 343.
Myrrhis andicola, 41.
Myrsine, 135.
Myrtaceæ (Chiloe), 140; (Diego Garcia), 337.
Mystacidium viride, 122.

Naga Hills, Botany of (Clarke), 128.
Nandina (Japan), 428; domestica, 429.
Nassauvia, 14.
Nassella cæspitosa = Oryzopsis cæspitosa, 58.
Nasturtium, 144, 441.
Negundo fraxinifolia, 105.
Nelumbium, gives out bubbles of air, 99; speciosum, 111.
Nephrodium aciculatum, 226; acuta, 228; calcaratum, var. falcilobum, 225; crassifolium, 225; ferox, 227; immersum, 225; intermedium, 226; Leuzeanum, 227; megaphyllum, 227; multisetum, 226; nudum, 228; procurrens, 227; pulvinuliferum, 226; sarawakense, 225; scabrosum, 226; setigerum, 226, 227; stenophyllum, 227; ternatum, 227; truncatum, 227; villosum, 227; unitum, 338.
Nepsera aquatica, 141.
Nettle, seed of, 346.
New instance of Apospory in Polystichum angulare (Druery), 438.
Nicandra physaloides, 53.
Nicotiana (Chicla), 5; glauca, 111; glutinosa, 53.
Nitella Baroni, 537; pseudoflabellata, 537.
Notes on Botany of Western South America, by John Ball, 137.
Nothoscordum striatum, 167.
Notochæte (Kohima), 130.
Notochlæna squamosa, 64.
Nuphar, 358.
Nuxia sphærocephala, 505; pachyphylla, 505, 506; terminalioides, 505.
Nyctagineæ (Andes, Peru), 9, 13, 54; (Diego Garcia), 338.
Nymphæa, 29, 358.

Oaks of Naga Hills, 130.
Observations, Phytobiological (Lubbock), 341.
Ochna macrantha, 457.
Ochnaceæ (S. Amer.), 146.
Ochrosia borbonica, 337, 339.
Ocotea (Mespilodaphne) trichantha, 515.
Odontoglossum crispum, 403.
Odontolejeunea, 324.
Œnothera, 378, 395, 397; epilobiifolia, 39; (cotyledons) 349; Lindleyana, 384; multicaulis, var. petiolaris, 38; prostrata, 39; psychrophila, 38; rosea, 39.
Olea cuspidata (seedling), 354; europea, 105.
Oleandra neriifolia, 228; neriifolia, var. phyllarthron, 228.
Oligomery (Orchids), 408.
Onagrarieæ, cotyledons of, 349; (Peru), 9, 38.
Oncophorus cyathicarpus, 302.
Oncostemum, 441; botryoides, 502; flexuosum, 502; microsphærum, 501; polytrichum, 501; vacciniifolium, 501, 502.
Onoclea sensibilis, 219.
Ophelia, 135; (Jakpho), 133.
Ophioglossum reticulatum, 231.
Ophriosporus triangularis, 161.
Ophrys liliifolia, 289, 272; Loeselii, 272; nervosa, 262; paludosa, 272; rotundifolia, 268; trifolia, 269.
Opuntia (cotyledon) basilaris, 389; Labourtiana, 388.
Orchid flower, changes resulting from hybridization, 421; Combination of tendencies, 421; Conformation flower Cypripedium, 402, 404; Displacement, 416; Change in position of parts, 416: Gen. Plan of parts, 402—in Odontoglossum crispum, 402; in Arundina pentandra, 402; in Zygostates cornuta, 403; in Thelychiton, 403; in Pleione birmannica, 403; in Selenipedium, 404;—Distrib. of vascular bundles, 405; Hexandrous

flowers, 414; Hybrid plants, changes in, 422; Increase inner row of stamens, 445: Oligomery, 408; reduction parts 408, in Cypripedium Sedeni, 408, in C. barbatum, 409, in C. venustum, 409, in C. Lawrenceanum, 409; Partition, 415: Peloria, or regularity in arrang. parts, 417; regular peloria, 418; irregular peloria, 420: Pleiomery, 410, increased number of parts, 410, in Cypripedium superbiens, 411; Teratology of Cypripedium, 407; Tetrandrous flowers, 412; Triandrous flowers, 411.
Orchideæ of S. Africa (Bolus), 65.
Orchids from Madagascar (H. N. Ridley), 116; (Jakpho), 134.
Orchis bicornis, 66.
Oreomyrrhis, 15, 41; andicola, 41.
Oreophila taraxacoides = Hypochæris taraxacoides, 48.
Orobus vernus, 106.
Oroxylum indicum (seed), 381.
Orthotheca (African), 303.
Oryzopsis cæspitosa, var. peruviana, = Nassella cæspitosa, 58.
Osbeckieæ, tribe of Melastomaceæ (Madagascar), 475.
Ottelia alismoides, 233, 237; brasiliensis, 233; lancifolia, 238; lancifolia, var. fluitans, 238; plantaginea, 238, 239; scabra, 239; ulvæfolia, 238, 239; vesiculata, 237.
Ourisia chamædrifolia, 53; sp. ?, 53.
Ouvun, or Ou Van, or Anivona, native name of Phloga polystachya, 527.
Ovules, forms of (Lubbock), 345.
Oxalis albicans, 163; filiformis, 34; laureola, 343; laxa, 163; pubescens, 34, var. glabra, 34; sp. ?, 34, 110.
Oxysporeæ, tribe Melastomaceæ (Madagascar), 176.

Pachira (seedling), 355.
Pachypodium brevicaule, 503; densiflorum, 503.
Pæonia, sp., 105.
Paliurus, fruit, 397.
Paludella, 306.
Panama, isthmus, climate and veget., 137.
Panax (Sphæropanax) gomphophylla, 480.
Pandanus dyckioides, 527; montanus, 527 (=Sussea conoidea, 527).
Panicum polygonatum, 144; sanguinale, 338.
Papaver Rhœas, 106.
Papillaria (African), 314.
Paranephelium ovatum = Liabum ovatum, 46; uniflorum, 46.
Parietaria debilis, 56.
Parinarium emirnense, 469.
Parmelia perforata (African), 299.
Partition in Orchids, 415.
Paspalum conjugatum, 144; stoloniferum, 8; stoloniferum = P. racemosum, 57.
Passerina hirsuta, 101.
Passiflora, lobed leaves, 341; seed, 364; suberosa, 339.
Passifloraceæ (Andes, Peru), 9, 13, 39.
Patagonia, plants from, 167.
Patrinia (Kohima), 130.
Paxtonia, actinomorphic condition of, 419.
Payta, N. Peru, flora of, 148; climate and physical geography of, 149.
Pedicularis (Jakpho), 133.
Pedilanthus, 442; lycioides, 516.
Pelargium madagascariense, 454.
Pelargonium, 441; australe, seedling, 357; glaucum, 110; madagascariense, 454.
Pellæa pulchella, 64.
Pelliciera (S. Amer.), 146.
Peloria (Orchids), 417.
Pentapetes, 357; phœnicea (seedling), 359.
Pentas hirtiflora, 482.
Pentstemon barbatus, 106.
Perezia ciliaris = Clarionea ciliaris, 47; multiflora, var., 47.
Pernettya empetrifolia, 167; pumila, 168.
Petioles, 375.
Petiveria octandra (cotyledon), 371, 379.
Phacelia (Andes) circinata, 50.
Phalænopsis, actinomorphic condition of, 419.
Pharus latifolius, 108.
Phaseolus multiflorus (seed), 106, 363; vulgaris (cotyledon), 393.
Philadelphus coronarius, 105.
Philippia capitata, 499; cryptoclada, 499; hispida, 499; minutifolia, 500; trichoclada, 500.
Phillyrea (ovule), 397.
Phloga polystachya = Dypsis nodifera, 527.
Phlomis tuberosa (connate cotyledon), 377.
Phlox (Andes), 20.
Phragmicoma emergens, 323; florea, 323; Palisoti, 324; Pappeana, 323.
Phylesia buxifolia, 168.
Phyllanthus Niruri, 338.

Physalis Peruviana=P. edulis, 53.
Phytobiological Observations (Sir J. Lubbock), 341.
Phytolacca octandra, 55.
Phytolaccaceæ (Andes, Peru), 9, 12, 55.
Picea amabilis, 171, 184, 192, var. magnifica, 192, var. robusta, 192; bifolia, 183; concolor, 177, var. violacea, 177; Fortunei, 197; grandis, 174, 181; hirtella, 195; lasiocarpa, 174, 175; Lowiana, 175; magnifica, 192; nobilis, 188; Omorika, 203, 204, 205, 212; orientalis, 203, 205; Parsonsiana, 175; religiosa, 194.
Pilea macropoda, 524.
Pilosella, 48.
Pilosperma (Andes), 146.
Pimpinella (Jakpho), 133.
Pines of Naga Hills, 130.
Pinus amabilis, 171, 184, 191, 192; Cembra, var. fruticosa, 205; concolor, 177; excelsa, 205, 207, 208; Fortunei, 197; grandis, 171, 174, 181; hirtella, 195; Kæmpferi, 208; Khasiana, 130; lasiocarpa, 184; Lowiana, 175; nobilis, 188; Peuke, 205, 206, 207, 208; religiosa, 195; rigida (seedling), 389.
Piper, 441; (Coccobryon) emirnense, 514; magnoliæfolium, 105.
Piptadenia leptoclada, 467.
Pisonia inermis, 335, 338; macrophylla, 335; viscosa, 335.
Pithecoctenium Aubletii (cotyledon), 381.
Pittosporum pachyphyllum, 444; Tobira, 105; vernicosum, 445.
Plagiochila abyssinica, 321; asplenioides, 319; Barteri, 320; cristata, 320; dichotoma, 319; dicrana, 320; javanica, 320; Lastii, 320; Neckeroidea, 320; sarmentosa, 319; sinuosa, 319; squamulosa, 319; tenebrans, 319.
Plagiogyria glauca, 132; pycnophylla, 132.
Plagiothecium membranosulum, 316; nitidifolium, 316.
Plantagineæ (Andes, Peru), 9, 54.
Plantago Hartwegii, 54; lanceolata, 106; media, 106; sericea, var.,=P. leucophylla, 54.
Plants, Cruickshanks on, W. coast of S. America, 157.
—— indigenous to Diego Garcia (Hemsley), 337.
—— of Rimac Valley (Ball), 28.
——, Swiss Alps and Peruvian Andes compared (Ball), 12.
Platanus, cotyledon of, 350, 351; fruit sect., 361; foss. Mull, 219, 220; occidentalis, 105.
Platycoryne Pervillei, 127.
Platystylis, 249, 258; alata, 245, 291; atropurpurea, 245, 279; decurrens, 245, 291.
Plectronia micrantha, 483.
Pleiomery (Orchids), 410.
Pleuridium tenuissimum, 300.
Pluchea Chingoyo, 156.
Plumbago Larpentæ, 106.
Poa annua, 61, and Poa, vars. (Nos. 1, 2, 3, 4, 5), 61, 62.
Podocarpus, foss. Mull, 219; nubigena, 168.
Podophyllum (Japan), 434; japonicum, 434; peltatum, 434, 435.
Poinsettia, sp., 110.
Polemoniaceæ (Andes, Peru), 9, 13, 20, 50.
Pollia (Kohima), 129.
Polyachrus echinopsoides, 47.
Polygala leptocaulis, 445.
Polygaleæ (Rimac, Peru), 9, 30.
Polygonaceæ (Andes, Peru), 9, 55.
Polygonatum (Jakpho), 136; multiflorum, 108.
Polygonum amphibium, 99; bistorta (connate cotyledon), 377; fruticulosum, 55; volcanicum=Muehlenbeckia volcanica, 55.
Polypetalæ (Peru), 10.
Polypodium atacamense, 64; alternidens, 228; (Phegopteris) Baroni, 535; campyloneuroides, 229; difforme, 228; dilatatum, var. grandidentatum, 230; flabellinervium, 228; incurvatum, 230; irioides, 229; leucophorum, 229; Melleri, 229; minimum, 228; musæfolium, 229; normale, var. sumatranum, 228; nummularifolium, 228; ornatum, 227; repandulum, 228; rupestre, 229; sarawakense, 228; selligueoides, 229; soridens, 228; squamatum, 64; superficiale, 228; triquetrum, 229.
Polypogon interruptus, 58.
Polyporus sanguineus, 340.
Polystachya cultrata, 121; fusiformis, 121; minutiflora, 121; rosea, 121.
Polystichum angulare, var. pulcherrimum, apospory in (Druery), 437, 438.
Poponia micrantha, 443.
Populus Carolinæ, 106; dilatata, 106; monilifera, 106; nigra, 106, pyramidalis, 106.
Porana (Kohima), 134.
Porella capensis, 323.
Porotrichum elegans, 315; flagellaceum,

315; Geheebii, 315; longirostrum, 315; madagassum, 315; pennæforme, 315; pennæforme, var. brachyphyllum, 315; ramulosum, 315; usagarum, 315.
Portulaca oleracea, 3; quadrifida, 337.
Portulacaceæ (Diego Garcia), 337; (Rimac, Peru), 32.
Poterium, 357, 390; Sanguisorba, 110; (seedling) 359, 398, (sect. seed) 379.
Premna serratifolia, 338.
Primula Auricula, 109, 114; capitata, 114; cortusoides, 114; denticulata, 114; farinosa, 108, 114; integrifolia, 114; luteola, 114; marginata, 114; purpurea, 114; sikkimensis, 114; sinensis (seedling), 398; stomata, leaves diff. species of (Darwin), 114.
Primulaceæ (absent in Andes), 10.
Prionodon densus, 312; Rehmanni, 311.
Prionolejeunea, 324.
Pritzelia zebrina, 105.
Prockia (S. Amer.), 146.
Prosopis juliflora, 151; limensis, 150.
Protophyllum (foss.), 220.
Prunus domestica, 105; Laurocerasus, 105.
Pseudolarix Kæmpferi, 208, 209, 211, 212.
Pseudoleskea plagiostoma, 318.
Pseudopanax racemiferum, 167.
Pseudotsuga Jezoensis, 197; magnifica, 191; nobilis, 188.
Psiadia cuspidifera, 489; modestus, 490; stenophylla, 490.
Psilotum triquetrum, 338.
Psorospermum emarginatum, 453; populifolium, 453.
Psychotria (Grumilea) mesentericarpa, 485; Parkeri, 485; reducta, 484; retiphlebia, 485.
Ptelea (ovary), 397.
Pteris ensiformis, 224; incisa, var. aurita, 224; longifolia, 224; marginata, 338; quadriaurita, 224, var. digitata, 224.
Pterobryum angustifolium, 312; filicinum, 312; flagelliferum, 312; Hanningtoni, 312; trichomanoides, 312.
Pterocarya, 357, 392; caucasica, (seedling) 359, (sect. nut) 386.
Pterogonium gracile, 316.
Pterygodium carnosum, 76; inversum, 76; magnum, 75; venosum, 76.
Pueraria (Nambre forest), 135.
Puerto Bueno (Patagonia), plants from, 167.
Puya? (Peru), 3.
Pyrrhobryum spiniforme, 308.
Pyrus (Jakpho), 136; communis, 105; Malus, 105.

Quercus Andersoni, 130; Griffithii, 130; pedunculata (seed), 397.
Quinchimalium ericoides, 56; gracile, 56.

Radula appressa, 323; Boryana, 323; mascarena, 323.
Rajania quinata, 424.
Ranunculaceæ, embryos, 393; (Rimac, Peru), 9, 28.
Ranunculus chiclensis, 28; (cotyledon), 371; Flammula, 107, 109; petiole, 398; subaqueous leaves, 348.
Raphanus Sativus (cotyledon), 369, 370.
Rayana quinata, 424; Rehmanni, 300; Giberti, 300.
Reidleia betsiliensis, 451.
Relation of the seedling to the seed, 400.
Report on vegetation of Diego Garcia, Hemsley on, 332.
Restiaceæ, develop. inner row stamens, 415.
Rhabdoweisia (African), 302.
Rhacopilum africanum, 308; angustifolium, 308; angusti-stipulaceum, 308; Ayresii, 308; capense, 308; longe-aristatum, 308; mauritianum, 308; mucronatum, 308; pectinatum, 308; prælongum, 308; Speluncæ, 308.
Rhamnus (cotyledon), 393; Frangula (seedling), 358.
Rheum (cotyledon), 398.
Rhipsalis crispata, 106, 107.
Rhizogonium spiniforme, 308.
Rhodea japonica, 105.
Rhodoclada, united with Asteropeia, 479.
Rhododendron arboreum, 132; Falconeri, 132; hirsutum, 105; ponticum, 105.
Rhodolæna, 441; Bakeriana, 447; altivola, 447.
Rhodosepala, 475; pauciflora, 475.
Rhodostachys bicolor, 166.
Rhus, 393; sp., 110; Thunbergii (cotyledon), 357, 360; typhina (seedling), 353.
Rhynchospora tenuis, 144; spermodon, =Dichronema setacea, 144.
Rhynchosia trichocephala, 465.
Rhyncoglossum, 135.
Rhyncotechum, 135.
Ribes aureum, 105.

Riccia spuria, 327.
Ricinus sanguineus (seedling), 348, 351, 363.
Ridley, H. N., Freshwater Hydrocharideæ of Africa and its Islands, 232.
——, Monograph of Genus Liparis, 244.
——, On Dr. Fox's coll. of Orchids from Madagascar, 116.
——, On Rev. R. Baron's coll. of Orchids from Madagascar, 116.
Rigodium Lechleri, 317.
Rivina lævis, 339; (seedling), 352.
Robinia Pseudacacia, 110.
Rosa, sp., 110.
Rosaceæ (Peru), 9, 37.
Roscoea (Nambre forest), 134.
Rostkovia grandiflora, 168.
Rotala cordifolia, 478.
Rotboellia gracillima, 533; cæspitosa, 533.
Rourea, united with Byrsocarpus, 462.
Rubia tinctorum, 105.
Rubiaceæ (Andes, Peru), 42; (Diego Garcia), 337; (Jakpho), 134; (Rimac), 9, 42.
——, tribe Spermacoceæ (Madagascar), 485.
Rubus (Kohima), 129, 130; moluccanus, 133.
Ruellia, 390; flava (seedling), 353; longifolia (seed), 364.
Rumex Acetosa, 106.
Rumphius's plates of Limo, 216.
Ruta graveolens, 110.
Ryania chocoensis, 141.

Saccularia Veatchii, 153, 154.
Sachs on stomata on leaves of water-plants, 99.
Salisburia adiantifolia, 105.
Salix Humboldtiana, 4.
Salvia Cruikshanksii, 54; rhombifolia, 54; strictiflora, 54.
Sambucus peruviana, 5, 41.
Santalaceæ (Andes, Peru), 9, 55, 56.
Sapindus (seedling), 357, 378, 393; inæqualis (seedling), 360.
Saponaria officinalis, 106.
Sargassum, 340.
Satyrium amœnum, 126; calceatum, 127; candidum, 66; debile, 67; emarcidum, 67; foliosum, 66; gigas, 116, 126; ligulatum, 67; ochroleucum, 66; ochroleucum, var. β. major, 66; trinerve, 126.
Sauvagesia erecta, 141.
Saxifraga cordillerarum, 5; cordillerarum, var. decipiens, 37; cordillerarum, var. nivalis, 37; decipiens, 37.
Saxifrageæ (Peru), 9, 37.
Scabiosa arvensis, 106; maritima, 164.
Scævola Koenigii, 334, 337.
Schinus, 372; molle, 4, terebinthifolius (seedling), 355.
Schismatoclada tricholarynx, 480.
Schistomitrium acutifolium, 302; apiculatum, 302; cucullatum, 302 Lowii, 302; robustum, 302.
Schizopetalon Walkeri (cotyledon), 386, 387, 388.
Schkuhria isopappa, 46.
Scirpus setaceus, var. pygmæus, 167.
Scrophularineæ (Andes, Peru), 9, 10, 13, 53; (Diego Garcia), 337.
Sedum, 37; acre, 107; album, 107; andinum, 38; (Jakpho), 133.
Seed, relation of seedling to, 400; size of, 390.
Seedling, of Cress, 345; of Mustard, 345.
Seedlings, Forms and Causes (Lubbock), 341, 344; relation to seed, 400.
Selaginella echinata, 536.
Selenipedium, 3-celled gynæcium, 404; caudatum, 420; Sedeni, 418.
Sempervivum tectorum, 107.
Senecio (Andes), 18, 441; compared with Trixis, 14; (Naga Hills), 129.
——, 441; acetosæfolius, 496; adenophylloides, 46; Anampoza=Cineraria Anampoza, 496; Bridgesii, 46; casapaltensis, 47; cicatricosus, 497; comosus, 46; cruentus, 385; cyclocladus, 406; erucæfolius (seedling), 385; glacialis, 46; glareosus, 46; (Kleinia) Hildebrandtii, 498; humillimus, var., 47; hyoseridifolius, 46; laurifolius, 343; Mandonianus, 47; melastomæfolius, 497; modestus, 47; monocephalus, 498; Pentlandianus, var., 46; Rabani (shrubby leaves), 129; Simonsii, 130; squalidus, 385; tamoides, 496; vernicosus, 497; viscosus, 385; vulgaris, 106, 165, 385; Wallichii, 129, 133.
Senecionideæ, 14.
Sequoia, foss. Mull, 219.
Sibthorpia, from Kilimanjaro, 299.
Sicyos subcorymbosus, 39.
Sida diffusa, 337.
Silene (Kohima), 136; inflata, 106.
Simarubeæ (Diego Garcia), 337.
Sisymbrium athrocarpum, 29; hirsutum, 29; myriophyllum, 29; titicacense, 29.
Sisyrinchium junceum, 56; junceum, var.=S. scirpiforme, 46.
Size of cotyledons, 394; of embryo, 393; of seeds, 390.

Skytalanthus acutus, 160.
Smyrnium perfoliatum (connate cotyledons), 377.
Solanaceæ (Andes, Peru), 9, 10, 51.
Solanum angustifolium, var., 52; chenopodioides, 52; Dulcamara, 108, 109; (fruit & seed), 366, 366; Maglia, 52; mammosum, var., 143; Pentlandi, 52; pulverulentum, 52; sp.? (Rimac Valley), 52; radicans, 52; rhamnoides, 52; ruderale, 52; tuberosum, 8, 51, 52, 105.
Solar Spectrum and Transpiration of Plants (Henslow), 81.
Sonchus oleraceus, 110.
Sophora japonica, 109.
South-African Botany, Contributions to (Bolus), 65.
South-American Botany and Botanical provinces (Ball), 147.
Spathodea campanulata (seedling), 358.
Spergularia (seed), 365.
Spermacoce linearis, 142; parviflora, 142.
Spiradiclis (Naga Hills), 135.
Statice incana, 107; latifolia, 106.
Stauntonia, β. chinensis, 423, 424; hexaphylla, 423, 424.
Stauranthera, 135.
Stelis micrantha, 292.
Stellaria (seed), 365; leptopetala, 31; media, 8, 31.
Stenomitrum (African), 305.
Stenotaphrum complanatum, 338.
Stenotheca, 48.
Stephanotis (seed), 364.
Stereophyllum nitens, 316; rivulare, 316.
Stevia paniculata, 43; sp.? (Chicla), 43.
Stipa chrysophylla, 161; tortuosa, 160.
Stoebe biotoides, 494; cryptophylla, 494.
Stomata in relation to bloom on leaves, 99.
Straits of Magellan, Botany of (Ball), 167.
Stratioteæ (African), 233, 237.
Streptocarpus caulescens, 299; Kirkii, 299; Rexii (cotyledon), 395.
Striga hirsuta, 337.
Strobilanthes hispidula, 509; (Jakpho) 134, 135; (Madagascar) 441.
Strychnos, 441; Baroni, 504.
Sturmia, 244, 255; abyssinica, 265; angustilabris, 287; bituberculata, 263; capensis, 272; elliptica, 265; Kappleri, 261; Loeselii, 272; nervosa, 262.
Suriana maritima, 337.
Sycamore, cotyledons, 362; seed, 401; straight veins, leaf of, 342.
Syringa vulgaris, 105.
Syrrhopodon asper, 303; circinatus, 303; Gaudichaudi, 303.
Systegium crispum, 304; unguiculatum, 304.

Tacca, 136.
Tacsonia Van-Volxemi (cotyledon), 385.
Tagetes multiflora, 46.
Taltal, paucity of veget., 156, 341.
Tamus, curved veins, leaf of, 341, 342.
Tanacetum vulgare, 106.
Targionia hypophylla, 328.
Taxus baccata, 105; fossil, 219.
Tecoma sambucifolia, 54.
Telanthera densiflora, 154; (Peru), 3; peruviana, var. decumbens, 155.
Telipogon, actinomorphic condition of, 419.
Temnolepis scrophulariæfolia, 495.
Tephrosia cinerea, 150; litoralis, 150; procumbens, 150.
Teratology of Cypripedium, 407.
Terminalia Catappa, 337.
Ternstrœmiaceæ, 146.
Tessaria ambigua, 156; (Peru), 3.
Tetrandrous flowers, 412.
Teucrium nudicaule, 157, 158.
Thalamifloræ (Madagascar), 442.
Thalia dealbata, 110.
Thalictrum macrocarpum, 28; podocarpum, 28.
Thamnium complanatum, 315.
Thea (cotyledon), 400.
Thelychiton, pelorioid form of, 419; stigma of, 403.
Thelymitra, actinomorphic condition of, 419.
Theophrasta Jussieui, 105.
Thesium cystoseiroides, 516.
Thibaudiæ (N. Andes), 148.
Thladiantha, 135.
Thuidium gratum, 318; lævipes, 318; tamariscinum, 318; versicolor, 318.
Thunbergia chrysochlamys, 508; coccinea, 135.
Thyridium africanum, 303; fasciculatum, 303.
Tiliaceæ, 146; (Diego Garcia), 337.
Tillæa connata=T. rufescens, 37.
Tina velutina, 462.
Tocophila, paucity of veget., 156.
Tonina fluviatilis, 143.
Tortula, 304.
Tournefortia argentea, 334, 337.
Trachyloma stipitatum, 313.

Trachypus crispatulus, 314; serrulatus, 314.
Tradescantia subaspera, 101; virginica, 109.
Transpiration of Plants and Solar Spectrum, Rev. G. Henslow on, 81.
Trematodon ligulatus, 300.
Triana and Planchon, summary plant-distrib. N. Granada, 145.
Trichocline (Peru), 13, 14.
Trichomanes brevipes, 223; fœniculaceum, 223; Hosei, 223; maximum, 223; parvulum, 223; saxifragoides, 223; Smithii, 223; tenue, 223.
Trientalis, 358.
Trifolium, 35, 114; alpestre, 115; amabile, var. pentlandi, 35; Aucheri, 115; cæspitosum, 115; chiclense, 35; elegans, 115; fragiferum, 115; Lupinaster, 115; medium, 115; minus, 115; montanum, 115; pannonicum, 115; peruvianum, 35; pratense, 110, 115; repens, 109, 115; repens, bloom protected surface of, (ftnote) 99; striatum, 115; uniflorum, 115.
——, stomata leaves diff. species of (Darwin), 115.
Trimen, H., Note on Balanophora Thwaitesii, Eichl., 330.
Trimorphopetalum, 454; dorstenioides, 455.
Triphasia trifoliata, 339, 373; (unequal cotyledons), 373.
Tristania, (ftnote) 220.
Tristellateia discolor, 456; emarginata, 456; stenoptera, 456.
Triticum sativum, 111.
Tritonia, sp., 110.
Triumfetta procumbens, 337.
Trixis, compared with Senecio, 14; frutescens, 156.
Trochelianthа (§ of Dombeya), 450.
Trollius europæus, 105.
Tropæolum, 110; (seedling), 393; tuberosum, 34.
Tunica (cotyledon), 364.
Turbinaria vulgaris, var. decurrens, 340.
Turræa rhombifolia, 458; venulosa, 458.

Ullucus tuberosus, 55; flabellata, 56.
Umbelliferæ (Andes, Peru), 40; (Rimac), 9, 40; (embryos), 393.
Unequal cotyledons, 369.
Unsymmetrical cotyledons, 372.
Uropedium, 412, 417, 420.
Ursinia speciosa (achene), 361.
Urtica, 379; dioica (achene), 380, 384.
Urticaceæ (Andes, Peru), 9, 55, 56.
Utricularia, sp. ? (Colombia), 138, 143.
——, subaqueous leaves, 343.

Vacciniaceæ (Jakpho), 133; (New Grenada), 147, 148.
Vaccinium Vitis-idæa, 101.
Valeriana armeriæfolia, 42; coarctata, 42; interrupta, 42, var. minor, 43; Phu, 106; remota, 42.
Valerianeæ (Peru), 8, 9, 42.
Vallisneria, 232, 233; æthiopica, 236; nana, 236; spiralis, 236.
Vallisneriæ (African), 232, 233, 236.
Valonia (Diego Garcia), 340.
Valparaiso, veget. of, 161.
Vanda cærulea, 134.
VascularCryptogamia(Madagascar),534.
Vascular plants, Diego Garcia, indigenous (Hemsley), 337.
Veprecella, 441; biformis, 447.
Verbena (Chicla), 5; diffusa, 5, 54; hispida, 54; litoralis, 54; officinalis, 54.
Verbenaceæ (Diego Garcia), 338; (Peru), 9, 54.
Vernonia, 441; betonicæfolia, 487; (Strobocalyx) capreæfolia, 487; cinerea, 337; (Strobocalyx) exserta, 488; (Strobocalyx) grisea, 488; rhodopappa, 487; stenoclinoides, 486.
Vicia Cracca, 109; sativa, 109.
Viguiera (Peru), 3.
Villanova oppositifolia, 46.
Vinca major, 105.
Viola (Jakpho), 136.
Viscum album, 106; glomeratum, 515; rhipsaloides, 516.
Vismia rufescens, 141.
Vitis (§ Ampelocissus), 441; rhodotricha, 461; sphærophylla, 460; vinifera, 105; (§ Cissus) Voanonala, 461.
Vittaria sulcata, 230.
Voamboana timber (Madagascar), furniture made from, 466.
Voanonala, native name of Vitis Voanonala, 461.
Vochysiaceæ (S. Amer.), 147.

Wahlenbergia peruviana, 49.
Walchia imbricata, 201.
Walnut (seed), 348.
Weinmannia leptostachya, 469.
Welwitschia (perisperm), 387, 394.
Wendtieæ (Peru), 13.
Werneria strigosissima, 47, = W. setosa, 47.
Western South America, Botany of (Ball), 137.

Wiesner's conclusions on light and plant-transpiration, 83–85.
Wild source of cultivated Limes (Dr. Bonavia), 213.
Woodsia obtusa, var., = Cheilanthus crenata, 63.

Xyridaceæ, develop. inner row stamens of, 415.

Yucca aloifolia, 106, 107.

Zapania cuneifolia, 154.
Zea Mays, 106.
Zilla myagroides (cotyledon), 380.
Zinnia elegans, 106.
Zygodon (§ Stenomitrium) erosum, 305; crenulatus, 306; pentastichus, 306; Priessianus, 301; Rehmanni, 306; rugifolius, 306; runcinatus, 306; strictissimus, 301; trichomitrius, 305; quitensis, 306.
Zygostates cornuta, 403.

END OF THE TWENTY-SECOND VOLUME.

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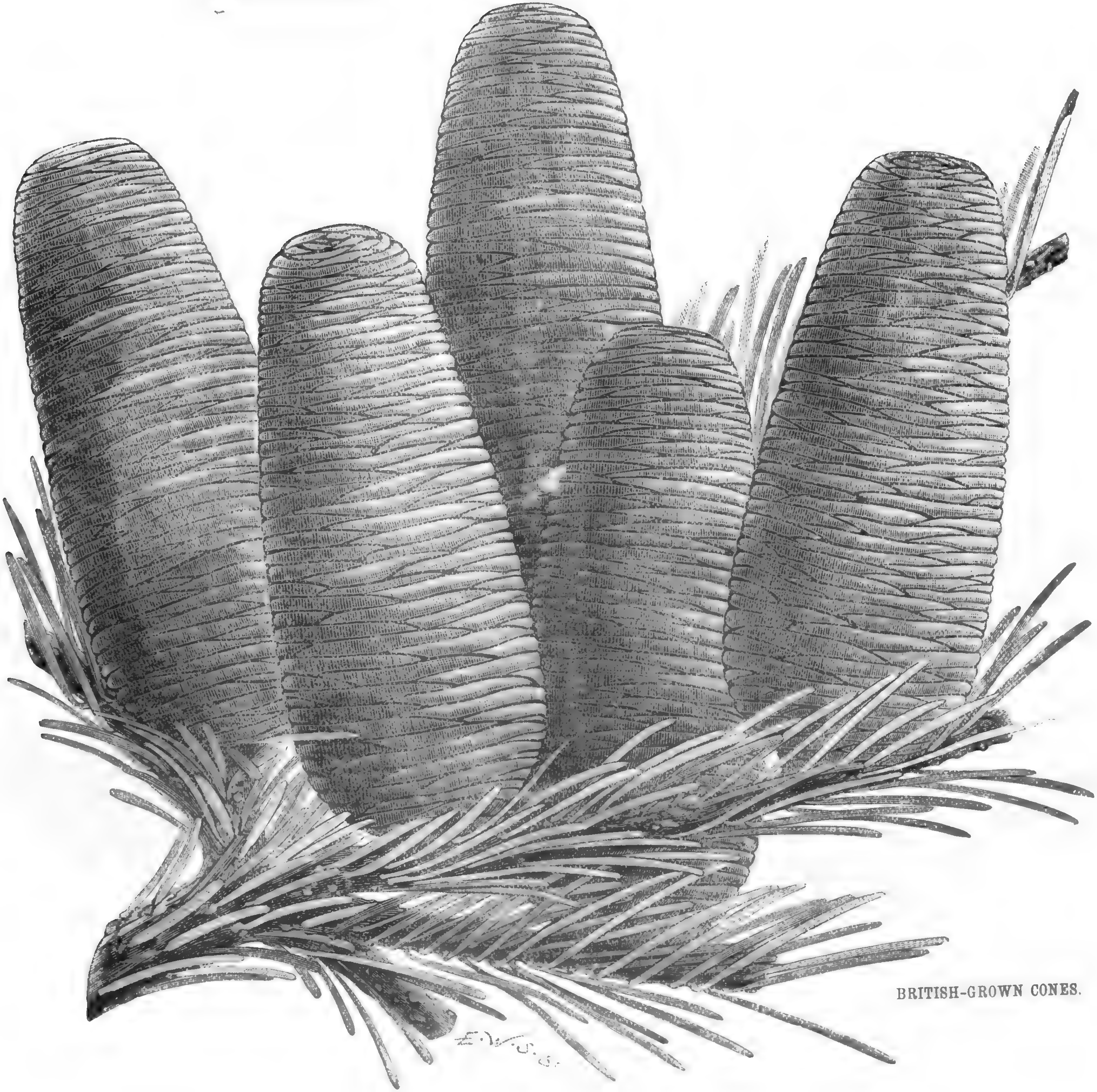
S. AFRICAN ORCHIDS SPECIES OF DISPERIS.
A. 1-5 D. Wealii. B. 6-12 D. oxyglossa. C. 13-17 D. Macowani.
D. 18-22 D. Woodii. E. 23-27 D. namaquensis. F. 28-33 D. Tysoni.

ABIES AMABILIS. STERILE BRANCH.

ABIES GRANDIS.



BRITISH-GROWN CONES.

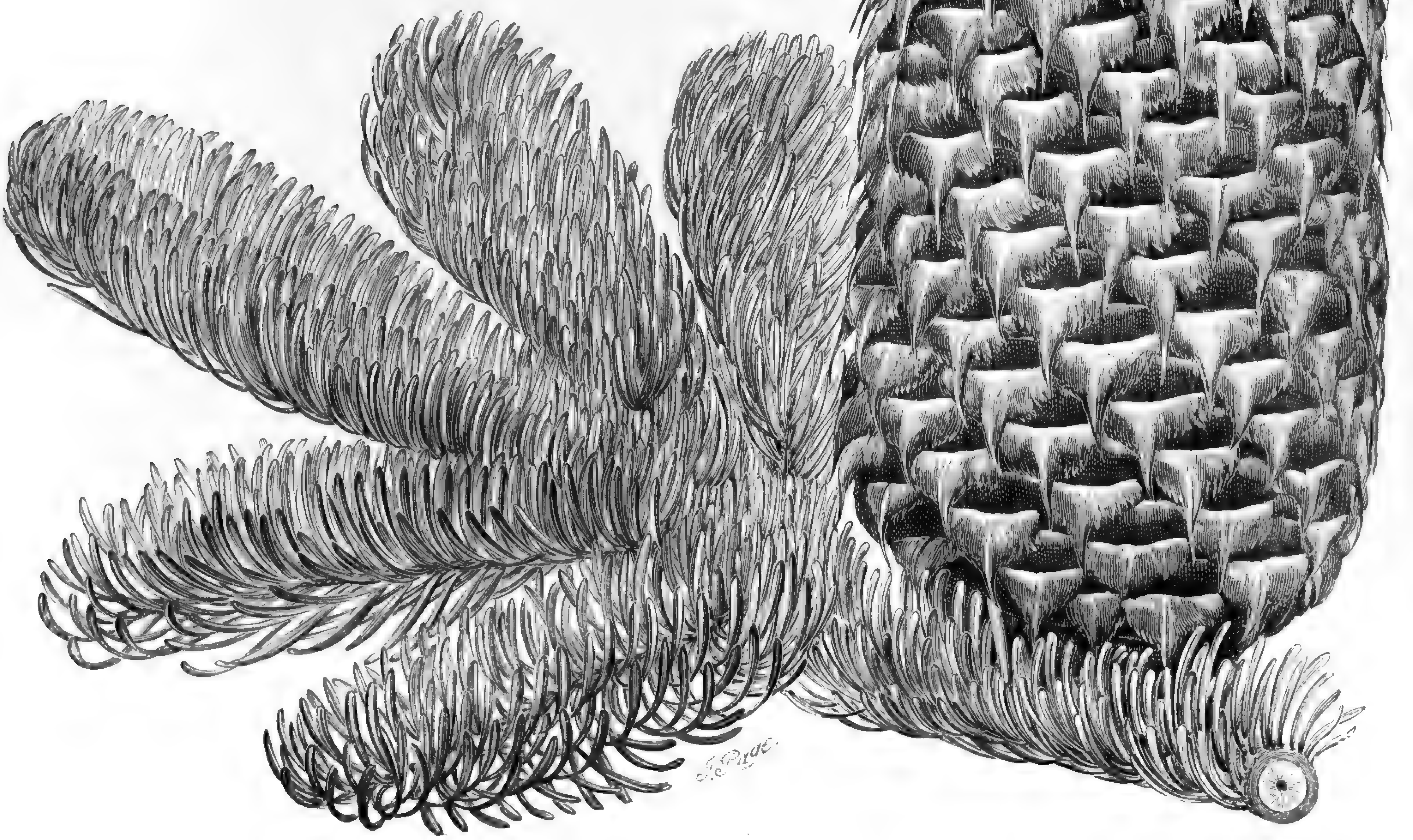
A

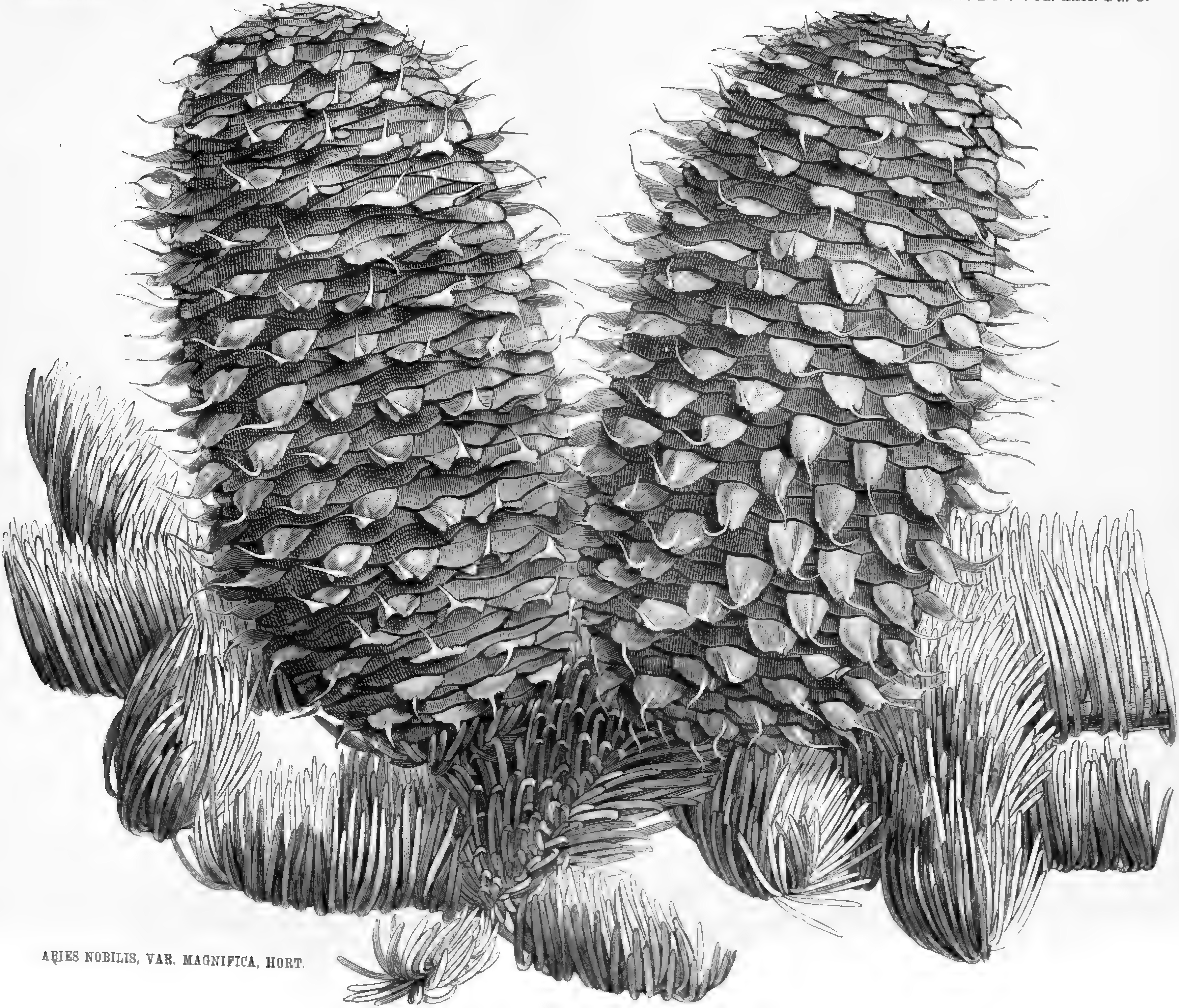
Section of leaf, magnified, showing groove on upper surface ; A A, resin canals.

B

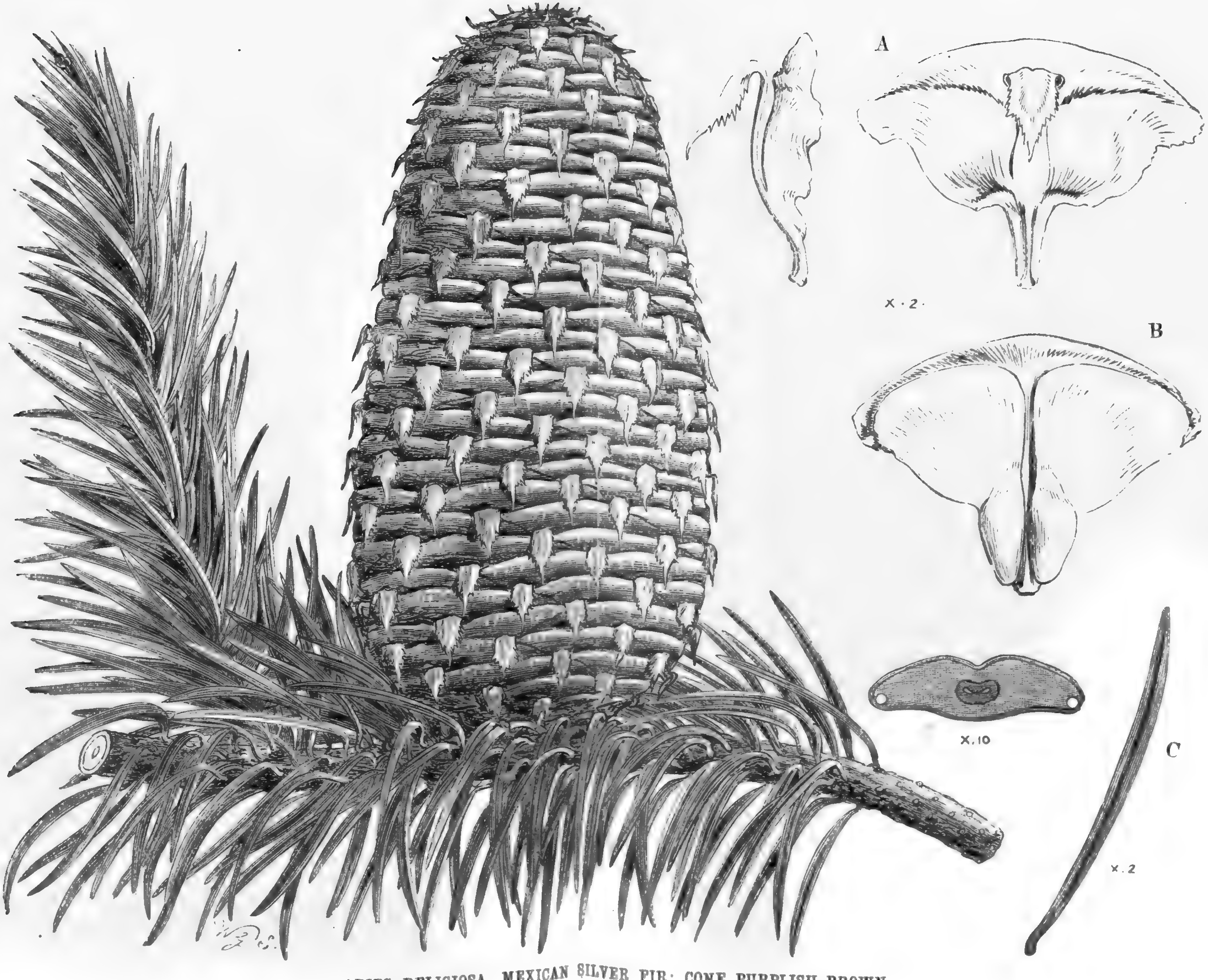
Seed, scales, and bracts of cultivated specimens.

ABIES NOBILIS.





ABIES NOBILIS, VAR. MAGNIFICA, HORT.



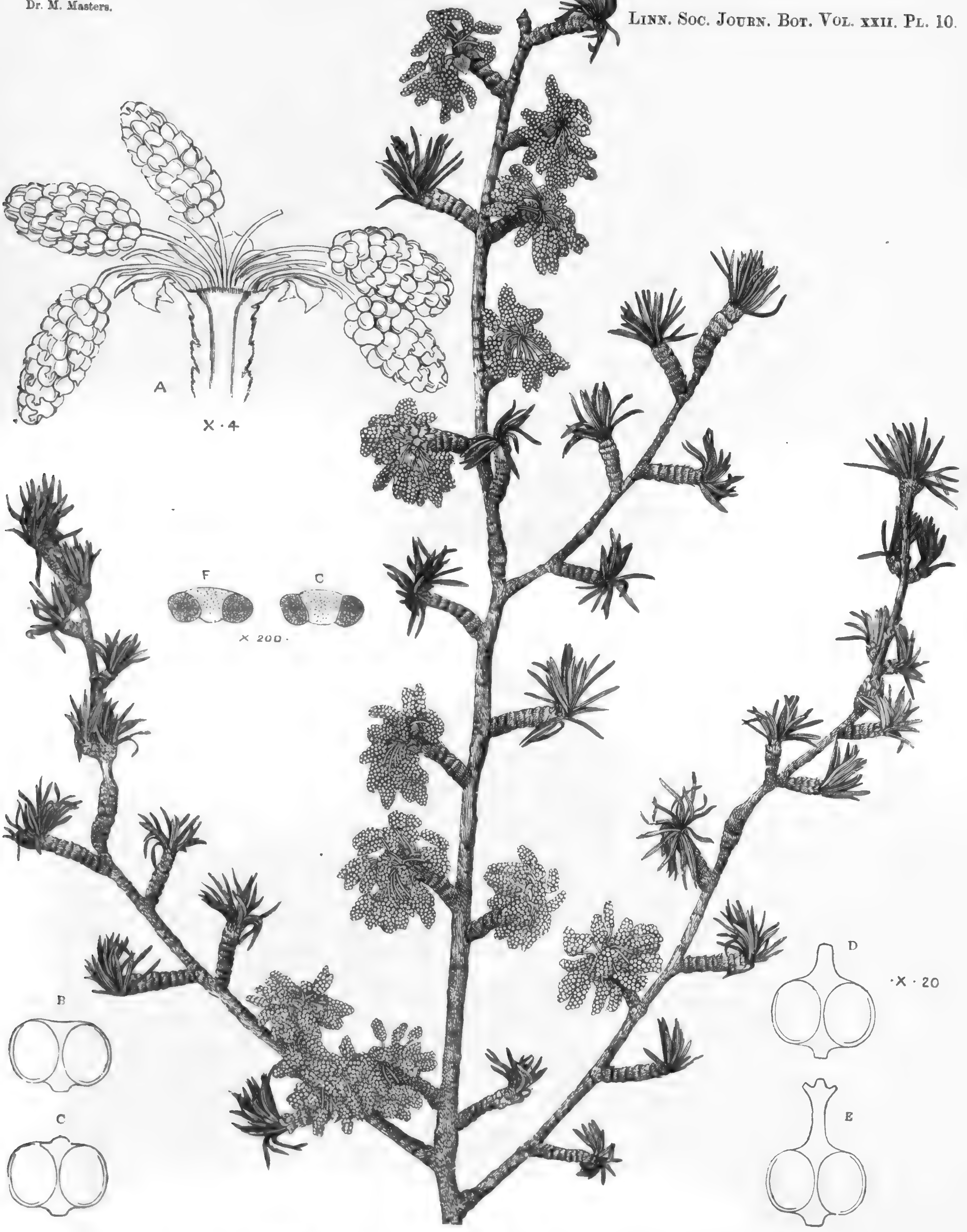
ABIES RELIGIOSA, MEXICAN SILVER FIR: CONE PURPLISH-BROWN.

CEPHALOTAXUS PEDUNCULATA, VAR. SPHÆRALIS.

PICEA OMORIKA, THE SERVIAN SPRUCE: NATURAL SIZE: FROM A PHOTOGRAPH.

Dr. M. Masters.

CONES OF PSEUDOLARIX KÆMPFERI: REAL SIZE.



REFERENCES:—A, Male catkins, section; B, C, D, E, Stamens (B, bottom, E, top, C, D, intermediate positions); F, G, Pollen.

Fig. 1.

Fig. 2

J. N. Fitch lith. Fitch [illegible]

NEPHRODIUM (SAGENIA) STENOPHYLLUM, *Baker*

Fig. 1.

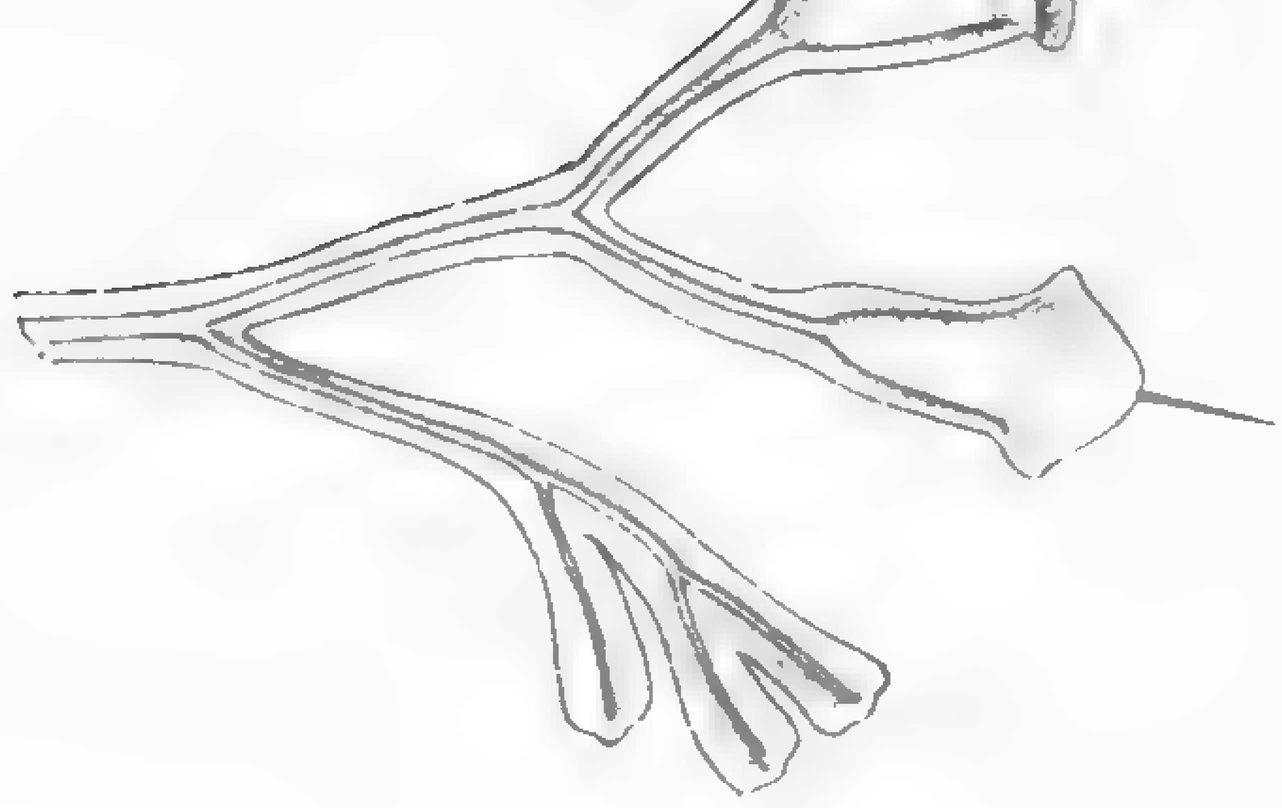


Fig 2.

J.N.Fitch lith

Fitch imp

TRICHOMANES HOSEI, *Baker*.

Sir J. Kirk del. BOOTTIA EXSERTA, *Ridley* Fitch lith

J.N. Fitch lith. BLYXA RADICANS, *Ridley*. Fitch imp.

E Carter sc. Mintern imp

1-4 ARCHIDIUM AFRIC[illegible] MANNI.
9-12. CAMPYLOPUS PERPUSILLU[illegible] 13-16. HYOPHILA PLICATA
17-19. ANŒCTANGIUM PUSILLUM. 20-22. PTEROBRYUM HANNINGTONI.

E. Carter sc. | Mintern imp

1-3 PTEROBRYUM FLAGELLIFERUM. 4-7 ERPODIUM HANNINGTONI.
8-10 PLAGIOCHILA SINUOSA 11-12 P. BARTERI.

1-3. PLAGIOCHILA LASTII. 4-6 P. DICRANA. 7-9. P. ABYSSINICA
10-14. LEIOCYPHUS INFUSCATUS.

E Carter sc.

Mintern imp

W. Mitten.

E. Carter sc.

Mintern imp

1-2. BAZZANIA PUMILA. 3-4. PHRAGMICOMA FLOREA.
5-8. LEJEUNEA HANNINGTONI. 9-12. L. ATRA. 13-16. L. SINUATA.

E. Carter sc. Mintern imp.

1-3. LEJEUNEA SERRULA 4-6. L. DEPLANATA. 7-9. L. ADHÆSIVA
10-11. L. DIGITALIS 12-14 FRULLANIA USAGARA.

SELENIPEDIUM CAUDATUM
INTERMEDIATE BETWEEN THE ORDINARY FORM AND UROPEDIUM.

(*See page* 419.)

J.N. Fitch lith. et imp.

ACHRYS TRIPHYLLA, D.C. *Var.* JAPONICA, *T. Ito*